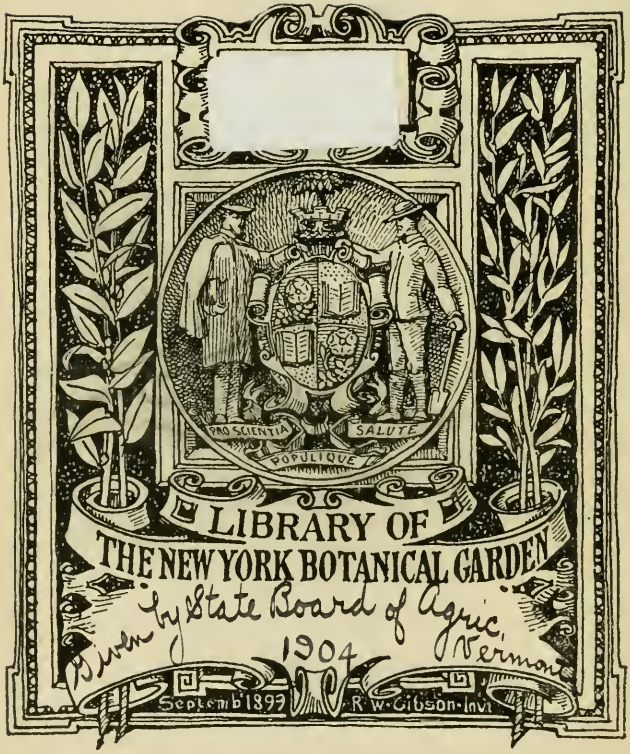
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Vermont Agricultural Report

BY THE

State Board of Agriculture

FOR THE YEAR

1899.

C. J. BELL,

Secretary of the Board.

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MEMBERS

OF THE

State Board of Agriculture,

1899.

HIS EXCELLENCY, EDWARD C. SMITH, St. Albans, *Chairman*.

MATTHEW H. BUCKHAM, President University of Vermont and State Agricultural College, Burlington.

C. J. BELL, Walden, P. O., East Hardwick, *Secretary*.

PROF. J. L. HILLS, Burlington.

JAMES K. CURTIS, Georgia, P. O., St. Albans.

1904

FORMER MEMBERS

OF THE

State Board of Agriculture.

1871–72.

His Excellency, JOHN W. STEWART.
James B. Angell, President State Agricultural College.
*Peter Collier, Secretary of the Board.

A. B. Halbert, Essex.
*Charles H. Heath, Plainfield.
Frederick Holbrook, Brattleboro.
*Pitt W. Hyde, Castleton.
*Z. E. Jameson, Irasburgh.
*Noah B. Safford, White River Junction.

1873–74.

*His Excellency, JULIUS CONVERSE.
Matthew H. Buckham, President State Agricultural College.
*Peter Collier, Secretary of the Board.

A. B. Halbert, Essex.
*Charles H. Heath, Montpelier.
*Francis D. Douglas, Whiting.
*Pitt W. Hyde, Castleton.
*Z. E. Jameson, Irasburgh.
Thomas H. Hoskins, Newport.

1875–77.

*His Excellency, ASAHEL PECK.
Matthew H. Buckham, President State Agricultural College.
*Peter Collier, Secretary of the Board.

Thomas L. Sheldon, Rupert.
Alexis T. Smith, New Haven.
*John B. Mead, Randolph.
*C. Horace Hubbard, Springfield.
Gardner S. Fassett, Enosburgh.
Cyrus D. Prindle Charlotte.
John H. Mead, West Rutland.

1877–78.

*His Excellency, HORACE FAIRBANKS.
Matthew H. Buckham, President State Agricultural College.
Henry M. Seeley, Secretary of the Board.

Gardner S. Fassett, Enosburgh.
*Peter Collier, Burlington.
*Albert Chapman, Middlebury.
*John H. Mead, West Rutland.
*Ora Paul, Pomfret.
Henry Chase, Lyndon.

1879–80.

Under change of law, John B. Mead, of Randolph, was "Superintendent of Agricultural Affairs."

1881–82.

His Excellency, ROSWELL FARNHAM.
Matthew H. Buckham, President State Agricultural College.
*Hiram A. Cutting, Secretary of the Board.

*Henry Lane, Cornwall.
*E. M. Goodwin, Hartland.
*M. W. Davis, Westminster.
*H. F. Lothrop, Pittsford.
Gardner S. Fassett, Enosburgh.
E. R. Towle, Franklin.
E. R. Pember, Wells.

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*Dead.

1883–84.

His Excellency, JOHN L. BARSTOW.
Matthew H. Buckham, President State Agricultural College.
*Hiram A. Cutting, Secretary of the Board.

*Henry Lane, Cornwall.
*E. M. Goodwin, Hartland.
E. R. Pember, Wells,
E. R. Towle. Franklin.
*W. M. Davis, Westminster.

1885–86.

His Excellency, SAMUEL E. PINGREE.
Matthew H. Buckham, President State Agricultural College.
*Hiram A. Cutting, Secretary of the Board.

*Henry Lane, Cornwall.
*M. W. Davis, Westminster.
E. R. Towle, Franklin.
*F. D. Douglas, Whiting.
A. E. Perkins, Pomfret.

1887–88.

His Excellency, EBENEZER J. ORMSBEE.
Matthew H. Buckham, President State Agricultural College.
W. W. Cooke, Secretary of the Board.

*Henry Lane, Cornwall.
*M. W. Davis, Westminster.
*D. L. Cushing, Quechee.
H. H. Hill, Isle LaMotte.
R. C. Smith, Pittsford.
H. W. Vail, Pomfret.
William Chapin, Middlesex.

1889–90.

His Excellency, WILLIAM P. DILLINGHAM.
Matthew H. Buckham, President State Agricultural College.
W. W. Cooke, Secretary of the Board.

*M. W. Davis, Westminster.
R. C. Smith, Pittsford.
H. W. Vail, Pomfret.
William Chapin, Middlesex.
C. M. Winslow, Brandon.

1891-92.

His Excellency, CARROLL S. PAGE.
Matthew H. Buckham, President State Agricultural College.
W. W. Cooke, Secretary of the Board.

R. C. Smith, Pittsford.
William Chapin, Middlesex.
H. W. Vail, Pomfret.
J. O. Sanford, Stamford.
Victor I. Spear, Braintree.

1893–94.

*His Excellency, LEVI K. FULLER.
Matthew H. Buckham President State Agricultural College.
C. M. Winslow, Brandon, Secretary of the Board.
Victor I. Spear, Braintree, Statistical Secretary.

H. W. Vail, Pomfret.
J. O. Sanford, Stamford.
Prof J. L. Hills, Burlington.
*H. M. Arms, Springfield.

1895–96.

His Excellency, URBAN A. WOODBURY.
Matthew H. Buckham, President State Agricultural College.
C. M. Winslow, Brandon, Secretary of the Board.
Victor I. Spear, Braintree, Statistical Secretary.

H. W. Vail. Pomfret.
J. O. Sanford, Stamford.
Prof. J. L. Hills, Burlington.
*H. M. Arms, Springfield.
F. C. Williams, Coventry.

1897–98.

His Excellency, JOSIAH GROUT.
Matthew H. Buckham, President State Agricultural College.
Victor I. Spear, Randolph, Secretary of the Board.
F. C. Williams, Coventry. Assistant Secretary of the Board.

J. O. Sanford, Stamford.
Prof. J. L. Hills, Burlington.
Alpha Messer, Rochester.
C. J. Bell, Walden.
J. K. Curtis, Georgia.
J. H. Ware, Townshend.

*Dead.

AN ACT TO PROVIDE FOR THE PRINTING OF THE REPORT OF THE VERMONT DAIRYMEN'S ASSOCIATION.

It is hereby enacted by the General Assembly of the State of Vermont:

SECTION 1. Section two hundred and forty-seven of the Vermont Statutes shall be amended so as to read as follows:

The Secretary shall prepare on or before the 30th day of June annually, a detailed report of the proceedings of the Board with such suggestions in regard to its duties and the advancement of the interests herein specified as may seem pertinent, and he may append thereto such abstracts of the proceedings of the several agricultural societies, and farmers' clubs in the State as may be advisable, and the report of the Vermont Dairymen's Association. The report shall show under separate heads the work of the Board relating to the different subjects herein mentioned.

SEC. 2. The provision of section two hundred and fifty-one of Vermont Statutes requiring the printing of a report by the Vermont Dairymen's Association is hereby repealed.

Approved November 24, 1896.

CHAPTER 203.

PRESERVATION OF CATTLE AND SHEEP.

SECTION
4802. Owner of diseased sheep running at large liable to penalty and damages.
4803. Sheep forfeited.

PLEURO-PNEUMONIA AND OTHER INFECTIOUS DISEASES.

4804. Penalty for bringing diseased cattle into State.
4805. Towns may take measures to protect themselves.
4806. Power of selectmen.
4807. Penalty for bringing diseased animals into State, or exposing them to others.
4808. Selectmen and alde men to make regulations; how enforced. To inquire and report.

BOARD OF AGRICULTURE.

4809. May prohibit introduction of diseased animals.

SECTION
4810. Penalty.
4811. To procure and publish information; may compel persons to testify.
4812. Witnesses' costs.
4813. May quarantine infected animals. Power to make investigations and regulations. Penalties.
4814. Penalty for offering or selling diseased animals.
4815. Value of animals ordered killed, appraisal and payment of.
4816. Expenses, how paid.
4817. Commissioners' regulations to take precedence.
4818. Commissioners to keep record and report.
4819. Orders, appointments and notices, majority to sign.
4820. Limitation of prosecutions.

SECTION 4802. If sheep are affected with the "hoof ail" or "foot rot," or with the "scab," the owner or keeper thereof shall restrain them from running at large in the public highways or commons, and keep them in an enclosure; and if he, knowing them to be diseased, knowingly permits them to go at

large upon a common or public highway, or if such sheep, while so diseased are found in an enclosure other than that of such owner or keeper, he shall be fined ten dollars, to the use of the town where such offense is committed, and shall also be liable to the party injured for the damages sustained, in an action upon this statute.

SEC. 4803. If sheep, infected with the "hoof ail" or "foot rot," are found at large upon a common, public highway, or lane, or lands not owned or occupied by their owner or keeper, through the neglect of such owner or keeper, said sheep shall become forfeit to any person who takes them up, and the owner of such sheep shall not have an action at law or equity for their recovery.

PLEURO-PNEUMONIA AND OTHER INFECTIOUS DISEASES.

SEC. 4804. If a person drives or brings domestic animals into this State, or is accessory thereto, knowing that any of them have the disease, or have been exposed to the disease, known as pleuro-pneumonia, he shall be fined not more than five hundred dollars, or be imprisoned not more than twelve months and not less than one month, in the discretion of the court.

SEC. 4805. A town, at a meeting held for that purpose, may establish regulations, appoint officers or agents, and raise and appropriate money to arrest and prevent the spread of the cattle disease known as pleuro-pneumonia.

SEC. 4806. The selectmen may perform all acts and make all rules and regulations for and in behalf of the town, necessary to carry into effect the powers conferred on the town by this chapter, until the town otherwise orders at a meeting holden for that purpose.

SEC. 4807. If a person brings into this State any domestic animals which he knows to be infected with an infectious or contagious disease, or exposes such cattle or other animals known to him to be so infected, to other cattle and animals not infected with such disease, he shall be fined not more than five hundred dollars, and not less than one hundred dollars.

SEC. 4808. The selectmen of the towns and the board of aldermen of the cities of this State, may make and enforce such regulations as they deem proper, to prevent the spread of infectious or contagious diseases among domestic animals, within their respective towns and cities, and shall inquire into all such cases coming to their knowledge, and shall immediately report the same to the governor. A person who knowingly violates or refuses to obey such regulations made by such town or city authorities, shall be fined one hundred dollars.

BOARD OF AGRICULTURE.

SEC. 4809. The Board of Agriculture may prohibit the introduction of horses or other domestic animals, believed to be infected with or exposed to any contagious disease, into this State, or may quarantine all such animals for such time as the public good requires; but shall not prohibit the transportation of the same in cars through this State.

SEC. 4810. If a person violates such order, after the same has been published three successive days in such newspapers published in this State as the Board directs, he shall be fined not more than three hundred dollars for each offense, and every officer or agent of any company or other person who violates such order, shall be fined as aforesaid. The introduction into this State at the same time of a number of horses, cattle or other domestic animals, contrary to the orders of such Board, shall be deemed a separate and distinct offense for each animal.

SEC. 4811. The Board shall endeavor to obtain full information in relation to any contagious disease which may prevail among domestic animals near the borders of the State, and publish and circulate such information at their discretion; and should any such disease break out, or should there be reasonable suspicion of its existence among cattle or other domestic animals, in any town in this State, they shall examine the cases and publish the results of their examination for the benefit of the public. The Board is also authorized to examine under oath, in the several towns and cities in this State, all persons possessing or believed to possess knowledge of any material facts concerning the existence or dissemination of diseases among domestic animals, and for this purpose shall have all the power now conferred upon justices of the peace to compel witnesses to attend and testify.

SEC. 4812. All costs and expenses incurred in procuring the attendance of such witnesses shall be allowed by the State auditor, upon the approval of the Governor, and be paid by the State.

SEC. 4813. When bovine tuberculosis or any contagious disease exists in the State among cattle or other domestic animals, the Board of Agriculture may quarantine all infected animals or such as they suppose have been exposed to the contagion, may prohibit any animal from passing on or over any of the highways near the place of quarantine, may enter upon any premises where there are animals suspected to have bovine tuberculosis or any contagious disease, may employ such expert help and means as they deem necessary to a thorough investigation of such diseases, may make all investigations and regulations they deem necessary for the detection, prevention,

treatment, cure and extirpation of such disease, but shall not apply the tuberculin test without the consent of the owner of the cattle, but in quarantine regulations against cattle imported from without the State the tuberculin test may be applied, and they may condemn and order killed any cattle or other domestic animals believed by said Board to be infected with bovine tuberculosis or any contagious disease, and may order the bodies of the same buried or burned, as in their judgment the case may require ; may forbid the sale or removal from the premises of any dairy product from cows that are believed to have bovine tuberculosis. Any person who shall knowingly violate or refuse to comply with any order or regulation of such Board, made under the authority of this section, shall be fined not more than two hundred dollars, or be imprisoned not more than two years, or both.

SEC. 4814. If any person shall sell or offer to sell any cattle or other domestic animal known to him to be infected with bovine tuberculosis or any contagious disease, or any disease dangerous to the public health, or shall sell or offer to sell any part or parts of such cattle or other domestic animals, he shall be fined not more than two hundred dollars or be imprisoned not more than two years, or both.

SEC. 4815. The value of all cattle or other domestic animals killed by the written order of the Board of Agriculture shall be appraised by one of said Board and a disinterested person selected by the owner of the condemned animals, if these two cannot agree upon the amount of the appraised value of the animal, they shall select a third disinterested person, who together with them shall appraise the animal, such appraisal to be made just before killing, and on a basis of health. The limit of the appraisal of cattle shall be forty dollars. A *post mortem* examination shall be made, and if the animal be found affected with bovine tuberculosis, or any disease dangerous to the public health, the owner of the animal shall receive one-half the appraised value ; but if no bovine tuberculosis or disease dangerous to the public health be found, the owner of the animal shall receive the full amount of the appraisal, and in addition shall receive the slaughtered animal. The amount which the owner is entitled to receive shall be paid by the State to the owner of such animal or animals upon a written order, signed by the member of the Board in charge, and countersigned by the secretary of said Board. No indemnity shall be paid to the owner of condemned cattle or other domestic animals that have not been owned and kept in the State for at least six months previous to the discovery of the disease. Any person who shall knowingly violate, or refuse to comply with any regulations made by such Board of Agriculture, under the

authority and provisions of this section, shall be fined not more than two hundred dollars, or imprisoned not more than two years, or both.

SEC. 4816. All expenses incurred by the Board under the provisions of this act shall be allowed by the State auditor, upon the approval of the Governor, and be paid by the State.

SEC. 4817. Whenever the Board shall make and publish regulations concerning the extirpation, cure or treatment of domestic animals infected with, or which have been exposed to, any contagious disease, such regulations shall supersede the regulations made by the selectmen of the several towns, or the board of aldermen of the several cities, upon the same subject; and the operation of such regulations made by said authorities, shall be suspended during the time those made by the Board as aforesaid are in force.

SEC. 4818. The Board shall keep a record of its doings and report the same to the Governor, prior to the fifteenth day of September, annually, unless sooner required.

SEC. 4819. All orders, appointments and notices from the Board shall be signed by a majority of the same.

SEC. 4820. Every prosecution for a violation of any of the provisions of this chapter, shall be commenced within sixty days from the commission thereof.

AN ACT TO AMEND SECTION 4820 OF CHAPTER 203 OF THE VERMONT STATUTES, RELATING TO PRESERVATION OF CATTLE AND SHEEP.

It is hereby enacted by the General Assembly of the State of Vermont:

SECTION 1. Section four thousand eight hundred and twenty of the Vermont Statutes is hereby amended so as to read as follows:

Every prosecution for a violation of any of the provisions of this chapter, shall be commenced within six months from the commission thereof.

SEC. 2. This act shall take effect from its passage.

Approved November 7, 1896.

CHAPTER 183.

REGULATING MANUFACTURE AND SALE OF PROVISIONS.

MILK AND CHEESE.

SECTION
4327. Milk, dilution or adulteration of, penalty for.
4328. Standard in creameries, etc.
4329. Samples tested for evidence.
4330. Disposition of samples.
4331. Standard milk defined.
4332. Fraudulent marking of butter and cheese.
4333. Jurisdiction of justice.

IMITATION BUTTER AND CHEESE.

4334. Manufacture of, prohibited.
4335. Penalty.
4336. Imitation of butter sold to be colored pink; penalty.
4337. Victualers using imitation not pink, subject to penalty.
4338. Analysis of specimens.
4339. Warrants to search for imitation butter.
4340. "Butter" defined.

LARD.

4341. All but pure fat of swine to be labeled. "compound lard."
4342. Penalty for selling unmarked.

MAPLE SUGAR AND HONEY.

4343. Penalty for adulterating maple sugar and honey.

MILK AND CHEESE.

SECTION 4327. A person who sells or furnishes, or has in his possession with intent to sell or furnish, milk diluted with water, adulterated, or not of good standard quality; or from which the cream or any part has been taken, or keeps back part of the milk known as "strippings" shall, for each offense, be fined not more than three hundred dollars and not less than fifty dollars.

SEC. 4328. In all creameries and cheese factories in this state milk containing four per cent. of butter fat shall be the standard used as a paying basis.

SEC. 4329. Where, in prosecutions under the preceding section the ordinary means of proof are not available or sufficient, sealed samples of the milk sold or furnished, or kept with intent to be sold or furnished, taken from such milk in the presence of at least one disinterested witness and with the knowledge and in the presence of the person or his agent or servant so selling or furnishing, or having in his possession with intent to sell or furnish said milk, may be sent to the state agricultural experiment station to be tested; the result of such test shall be deemed competent evidence in such prosecutions but shall not exclude other evidence.

SEC. 4330. Said samples shall be placed in tin or glass vessels securely sealed with a label thereon stating the time when, place where, the sample was drawn, from whose milk taken, and signed by the person taking the same and by one or more disinterested witnesses. Upon request a like sample shall be given to such person, his agent or servant, for which a receipt shall be given to the person taking or drawing the same.

SEC. 4331. Standard milk shall contain not less than twelve and one-half per cent. of solids, or not less than nine and one-fourth of total solids exclusive of fat, except in the months of May and June, when it shall contain not less than twelve per cent. of total solids. This rule shall govern tests made at the experiment station, and an officer or employee thereof found guilty of fraud in making tests shall be fined one thousand dollars.

SEC. 4332. A person who marks or otherwise designates or causes to be marked or otherwise designated as "creamery" butter or cheese, or the packages in which it is contained, when such butter or cheese is not manufactured at a creamery, or sells or offers to sell any such butter or cheese so marked, shall be fined not more than three hundred dollars and not less than fifty dollars.

SEC. 4333. Justices shall have concurrent jurisdiction with the county court in prosecutions under the four preceding sections.

IMITATIONS OF BUTTER AND CHEESE.

SEC. 4334. No person by himself, his agent, or servant, shall manufacture out of animal fat, or animal or vegetable oils not produced from unadulterated milk or cream, any article in imitation of butter or cheese, or mix with or add to milk, cream or butter any acids or other deleterious substances, animal fats, or animal or vegetable oils so as to produce an article in imitation of butter or cheese.

SEC. 4335. If a person violates the provisions of the preceding section he shall be fined not more than three hundred dollars, and not less than one hundred dollars, or be imprisoned for not more than one year and not less than six months for the first offense ; and for each subsequent offense shall be fined not more than one thousand dollars and not less than three hundred dollars, or imprisoned for one year. One-half of the fine shall go to the complainant.

SEC. 4336. If a person by himself, his agent, or servant, sells, exposes for sale, or has in his possession with intent to sell, any article made in imitation of butter, that is of any other color than pink, shall, for every package sold or exposed for sale, be fined fifty dollars, and for each subsequent offense one hundred dollars. One-half of the fine shall go to the complainant.

SEC. 4337. If a proprietor or keeper of a hotel, restaurant, boarding house, eating saloon or other place where food is furnished to persons paying for the same, places upon the table or has in his possession with intent to use, any article

made in imitation of butter, that is of any other color than pink, he shall be fined fifty dollars for the first offense, and for each subsequent offense one hundred dollars. One-half of the fine shall go to the complainant.

SEC. 4338. The complainant may cause specimens of suspected butter or cheese to be analyzed or otherwise tested as to color and compounds; the expense of such analysis or test not exceeding twenty dollars, in any one case, may be included in the cost of prosecution.

SEC. 4339. A justice of the peace may issue a warrant for searching, in the day-time, any store, hotel, boarding house, or other place where oleomargarine, butterine or other substance imitating butter or cheese is suspected to be kept or concealed, when the discovery of such articles may tend to convict a person of any offense under the five preceding sections.. No warrant shall be issued except upon the oath of some person that he has reason to suspect and does suspect that such article or articles are kept or concealed in the place to be searched.

SEC. 4340. The term "butter" shall mean the product usually known by that name, manufactured exclusively from milk or cream or both, with or without salt or coloring matter.

LARD.

SEC. 4341. No person by himself, his agent or servant, shall prepare, sell or expose for sale lard or any substance intended for use as lard, which contains any ingredient but the pure fat of swine, in any tierce, bucket, pail or other package under a label bearing the words "pure," "refined," or "family," alone or in combination with other words, unless the package containing the same bears upon the outside thereof, in letters not less than one fourth of an inch long, the words, "Compound Lard."

SEC. 4342. A person violating the provisions of the preceding section shall be fined not more than fifty dollars for each offense.

MAPLE SUGAR AND HONEY.

SEC. 4343. A person who adulterates maple sugar, maple syrup, or bees' honey with cane sugar, glucose, or any substance whatever, for the purpose of sale, or who knowingly sells maple sugar, maple syrup or bees' honey that has been adulterated, shall be punished by a fine of not more than two hundred dollars and not less than fifty dollars for each offense; one-half of such fine shall go to the complainant.

CHAPTER 222.

OFFENSES AGAINST PUBLIC HEALTH.

SEC. 5073. A person who knowingly sells diseased, corrupted or unwholesome provisions, for food or drink, shall be imprisoned not more than six months, or fined not more than three hundred dollars.

SEC. 5074. A person who kills or causes to be killed, with intent to sell the meat thereof for family use, a calf less than four weeks old, or knowingly sells or has in his possession such meat with intent to sell the same in the state, or to send the same for such use to any foreign market, shall be punished as provided in the preceding section.

CHAPTER 21.

BOARD OF AGRICULTURE.

SECTION
245. Members; vacancies.
246. Meetings.
247. Report.
248. Statistical information.

SEC. 245. The Governor, the President of the University of Vermont and State Agricultural College, and three other persons appointed by the Governor, and confirmed by the senate during each biennial session of the General Assembly and who shall hold their office for the term of two years from and after the first day of December in the year in which the appointment is made, shall constitute the Board of Agriculture for the improvement of the general interests of husbandry, the promotion of agricultural education throughout the State, and for the discharge of such other duties as are hereinafter set forth; vacancies in the Board shall be filled by the Governor. Said Board shall appoint from its number a Secretary.

SEC. 246. The Board shall hold one meeting in each county annually, and others if deemed expedient, and may employ lecturers, essayists or other aid in conducting said meetings, managing its affairs generally and discharging its duties. At such meetings it shall present subjects for discussion, and among other topics forestry and tree planting, roads and road making.

SEC. 247. The Secretary shall prepare on or before the thirtieth day of June, annually, a detailed report of the proceedings of the Board, with such suggestions in regard to its duties, and the advancement of the interests herein specified

as may seem pertinent; and he may append thereto such abstracts of the proceedings of the several agricultural societies and farmers' clubs in the State as may be advisable. The report shall show under separate heads the work of the Board relating to the different subjects herein mentioned.

SEC. 248. The Board shall collect authentic statistical information, as full as possible, relating to agriculture and agricultural products, farms and farm property, the manufacturing and mining industries of the State, which, under a separate head, shall form a part of its annual report; and such information shall be complete as to unoccupied farms. The Board shall also publish such information in separate form, showing by description and illustration, the resources and attractions of Vermont; also the advantages the State offers and invitations it extends to capitalists, tourists, and farmers; and shall distribute the same in such manner as, in its judgment, will be most effective in developing the resources and advertising the advantages of the State.

CHAPTER 184.

COMMERCIAL FERTILIZERS.

SECTION
4346. "Commercial fertilizer" defined.
4347. "Importer" defined.
4348. Packages to be branded and bear label of contents.
4349. Samples and certificates to be deposited before sale.
4350. License for sale of, to be obtained.
4351. Manufacturers and importers to file bond.
4352. "Pulverized leather" to be so marked.
4353. Penalties.
4354. Lists of brands and agents to be furnished; to whom.
4355. Analyses to be made and how.
4356. State treasurer to be notified and commence suit.
4357. Shall give parties thirty days to comply with law.
4358. Prosecution, when not to be made.
4359. Analyses, by whom made, license fees, how expended.

SECTION 4346. The term "commercial fertilizer" as used in this chapter shall mean compounds and manufactured substances containing or represented as containing, two or more of the following ingredients, namely: nitrogen, ammonia, potash and phosphoric acid, but shall not apply to the separate ingredients used to manufacture the same, or to bone meal, land plaster, lime, or any substance the product of nature, which has not been compounded.

SEC. 4347. The term "importer" as used in this chapter shall mean a person who procures or sells fertilizers made in other states.

SEC. 4348. Every lot or parcel of commercial fertilizer, or material used for manurial purposes, sold, or exposed for sale, the retail price of which is ten dollars or more per ton, shall be

accompanied by a plainly printed statement, clearly and truly certifying the number of net pounds of fertilizer in a package, the name, brand or trade-mark under which the fertilizer is sold, the name and address of the manufacturer or importer, the place of manufacture, and a chemical analyses stating the percentage of nitrogen or its equivalent in ammonia, of potash soluble in distilled water and of phosphoric acid soluble in distilled water and reverted, as well as the total phosphoric acid. Fertilizers composed of other and cheaper materials, shall bear labels giving a correct general statement of the composition and ingredients thereof.

SEC. 4349. Before any commercial fertilizer, the retail price of which is ten dollars or more per ton, is sold, or exposed for sale, the importer, manufacturer or party who causes it to be sold, or offers it for sale, shall file with the director of the agricultural experiment station a certified copy of the statement required by the preceding section, and shall also deposit with said director, at his request, a sealed jar, glass or bottle containing not less than one pound of the fertilizer, accompanied by an affidavit that it is a fair average sample thereof.

SEC. 4350. The manufacturer, importer or agent of a commercial fertilizer or material used for manurial purposes, the retail price of which is ten dollars or more per ton, shall, before the fertilizer is offered for sale, obtain a license from the state treasurer, countersigned by the director of the agricultural experiment station, authorizing the sale of the same in the state and shall securely affix to each barrel, bag or other package of fertilizer the word "Licensed," with the date of the license. The manufacturer, importer or agent obtaining such license shall pay to the state one hundred dollars for the same and the license shall expire on the thirty-first day of December of the year for which it is issued. One license shall cover all brands manufactured by one party.

SEC. 4351. Manufacturers and importers of a commercial fertilizer sold or offered for sale, the retail price of which is ten dollars or more per ton, shall, before such fertilizer is sold, or exposed for sale, file with the state treasurer a bond, with sureties residing within the state satisfactory to said treasurer, in the sum of one thousand dollars, payable to the state and conditioned for the payment of fine and costs imposed on such manufacturers and importers for violating the provisions of this chapter, and such bond shall be renewed from time to time, as the state treasurer requires.

SEC. 4352. No person shall sell, or expose for sale, any pulverized leather in any form, as a fertilizer, or as an ingredient thereof, without an explicit printed certificate of the fact conspicuously affixed to each package.

SEC. 4353. A person selling or exposing for sale a commercial fertilizer without the statement required by this chapter, or containing a smaller percentage of any one or more of the ingredients named than is specified on the label, or who fails to comply with any of the preceding sections of this chapter, shall be fined fifty dollars for the first offense and one hundred dollars for each subsequent offense. This section shall not affect parties manufacturing, importing or purchasing fertilizers for their own use.

SEC. 4354. Manufacturers and importers of commercial fertilizers or wholesale dealers in the same shall, not later than the first day of February, annually, furnish the director of the agricultural experiment station with the names of the brands offered for sale and their agents in this state, and on the first of each succeeding month until May, such additional agents as in the meantime have been appointed.

SEC. 4355. Said director shall cause one analysis or more of each fertilizer or material used for manurial purposes, to be made annually and the result published monthly. He may, in person or by deputy, take a sample not exceeding two pounds in weight for analysis from any lot or package of fertilizer, or any material used for munurial purposes, which is in the possession of any manufacturer, importer, agent or dealer ; but said sample shall be drawn in the presence of the party in interest, or his representative, and shall be taken from a parcel or nnmber of packages which shall not be less than five of the whole lot inspected, and shall be thoroughly mixed and then divided into two equal samples and placed in glass vessels, carefully sealed, and a label placed on each stating the name of the brand of the fertilizer or material sampled, the name of the party from whose stock the sample was drawn, and the time and place of drawing. Said label shall be signed by the director or his deputy and by the party in interest, or his representative present at the drawing and sealing of said samples ; one of said duplicate samples shall be retained by the director and the other by the party whose stock was sampled.

SEC. 4356. The director of the agricultural experiment station shall notify the state treasurer of all violations of this chapter and the state treasurer shall commence a suit, in the name of the state, on the bond required to be filed by such manufacturer or importer and prosecute the same to final judgment.

SEC. 4357. Whenever any violations of this chapter are brought to the attention of the state treasurer, he shall give written notice thereof to the manufacturers and importers, and they shall have not less than thirty days thereafter to comply with the requirements of the law.

SEC. 4358. If the fertilizer or fertilizing material is substantially equivalent to the statement of analysis made by the manufacturers or importers, no prosecution shall be had under this chapter. All analyses of fertilizers provided for by this act, including the collection of samples for such analyses, shall be made by the director of the Vermont Agricultural Experiment Station at the expense of said station, and so much of the license fees collected under this act shall be paid by the state treasurer to the treasurer of said station as the director of said experiment station may show by his bills he has expended in performing the duties required by this chapter, but in no case to exceed the amount of the license fees received by the treasurer under this chapter, such payment to be made annually on or before the first day of September, upon the order of the state auditor, who is hereby directed to draw his order for such purpose.

No. 81.—AN ACT FOR THE PROTECTION OF DAIRYMEN, RELATING TO TESTING MILK AND CREAM.

It is hereby enacted by the General Assembly of the State of Vermont:

SECTION 1. All bottles, pipettes or other measuring glasses used by any person, firm or corporation, or their agents or employes, at any creamery, butter factory, cheese factory or condensed milk factory, or elsewhere in this State, in determining by the Babcock test, or by any other test, the value of milk or cream received from different persons or parties at such creameries or factories, shall, before such use, be tested for accuracy of measurement and for accuracy of the per cent. scale marked thereon. It shall be the duty of the superintendent of the dairy school of the University of Vermont and State Agricultural College to designate some competent person to test the accuracy of such bottles, pipettes, or other measuring glasses. The person thus designated shall so mark such bottles, pipettes or other measuring glasses as are found correct in marks or characters which cannot be erased, which marks or characters shall stand as proof that they have been so tested; and no incorrect bottles, pipettes or other glasses shall be thus marked. The superintendent of the dairy school shall receive for such service the actual cost incurred and no more, the same to be paid by the persons or corporations for whom it is done.

SEC. 2. Each and every person who, either for himself or in the employ of any other person, firm or corporation, manipulates the Babcock test, or any other test, whether mechanical or chemical, for the purpose of measuring the contents of but-

ter fat in milk or cream as a basis for apportioning the value of such milk or cream, or the butter or cheese made from the same, shall secure a certificate from the superintendent of the dairy school of the University of Vermont and State Agricultural College that he or she is competent and well qualified to perform such work. The rules and regulations in the application for such certificate and in the granting of the same shall be such as the superintendent of the school may arrange. The fee for issuing such certificate shall in no case exceed one dollar, the same to be paid by the applicant to the superintendent of the dairy school and to be used by the superintendent in meeting the expenses incurred under this section.

SEC. 3. Any person or persons violating any of the provisions of this act, shall, on conviction in a court of competent jurisdiction, be fined not more than twenty-five dollars for the first offense, and not more than fifty dollars for each subsequent offense. It shall be the duty of every sheriff, deputy sheriff and constable to institute complaint against any person or persons violating any of the provisions of this act, and, on conviction, one-half of the fines shall go to the complainant and the balance to the State.

Approved November 19, 1898.

No. 82.—AN ACT IN RELATION TO CREAMERIES AND CHEESE FACTORIES AND THE MANAGEMENT OF THE SAME.

SECTION
1. Owners of creameries to deliver to patrons monthly, detailed statement.
2. Creameries must weigh, sample and test milk.
3. Owners of cheese factories to deliver to patrons detailed monthly statement.
4-5. Owners of creameries to make monthly statement of total receipts of milk and pounds of butter produced.
6. Penalty for neglecting to comply with act.
7. Act takes effect January 1, 1899.

It is hereby enacted by the General Assembly of the State of Vermont:

SECTION 1. Every owner, operator or manager of a creamery in this State, whether co-operative or proprietary, shall monthly make and deliver to each of the patrons of said creamery a statement of the number of pounds of milk or cream such patron delivers for that month, together with the test, pounds of butter fat, gain per cent. from the churn, and actual pounds of butter produced from said milk, and the price paid for the same shall be computed on the actual pounds of butter.

SEC. 2. Any owner, operator or manager of any creamery, whether co-operative or proprietary, who sells or otherwise disposes of any of the milk received at such creamery, shall

weigh and carefully sample the same, and shall test such samples, for the purpose of ascertaining the number of pounds of butter fat in such milk sold, or otherwise disposed of, and the gain per cent. which is found to be the gain from the churn for that month shall be the one used in ascertaining the actual number of pounds of butter produced from such milk as is sold or otherwise disposed of.

SEC. 3. The owner, operator or manager of any cheese factory in the State, whether co-operative or proprietary, shall make and deliver to each of the patrons of said factory a statement representing the number of pounds of milk he delivers for each month, together with the test and actual number of pounds of cheese produced by such milk for said month. And the price paid for the same shall be computed on actual number of pounds of cheese.

SEC. 4. Every owner, operator or manager of a creamery in this State, whether co-operative or proprietary, shall make a statement each month of the total number of pounds of milk received for that month, together with the gain per cent. from the churn, and actual number of pounds of butter produced from said milk and cream.

SEC. 5. The statement mentioned in the preceding section shall be posted in a conspicuous place in said creameries.

SEC. 6. Any manager or proprietor of any creamery or cheese factory in the State, who after request by any person refuses, or neglects for the space of ten days, to comply with any of the provisions of this act, shall forfeit to said person ten dollars for each refusal or neglect, to be recovered by an action founded on this statute.

SEC. 7. This act shall take effect January 1, 1899.

Approved November 29, 1898.

No. 83.—AN ACT TO REGULATE THE SALE OF CONCENTRATED COMMERCIAL FEEDING STUFFS.

SECTION
1. Concentrated commercial feeding stuff on sale must bear printed statement of certain facts.
2-3. Concentrated commercial feeding stuff defined.
4. Copy of statement required by section 1 must be filed with director of experiment station, and samples supported by affidavit submitted to him.
5. Inspection tax.
6. Penalties.
7. Manufacturers and importers shall furnish certain information to director of experiment station.
8. Provisions for making analysis of feeding stuffs offered for sale.
9. Prosecutions for violations, how conducted.
10. Term "importer" defined.
11. Inconsistent acts repealed.
12. Act takes effect July 1, 1899.

It is hereby enacted by the General Assembly of the State of Vermont:

SECTION 1. Every lot or parcel of any concentrated commercial feeding stuff, as defined in section three of this act,

used for feeding farm live stock, sold, offered or exposed for sale in the State of Vermont, shall, in addition to the tax tag described in section five of this act, have affixed thereunto, in a conspicuous place on the outside thereof, a plainly printed statement clearly and truly certifying the number of net pounds of feeding stuff in a package, the name, brand or trade mark under which the article is sold, the name and address of the manufacturer or importer, the place of manufacture, and a chemical analysis stating the percentages it contains, of crude protein, allowing one per cent. of nitrogen to equal six and one-fourth per cent. of protein and of crude fat, both constituents to be determined by the methods adopted at the time by the Association of Official Agricultural Chemists; provided that the statement of the percentage of crude fat may be omitted if it does not exceed three per cent.

SEC. 2. The term concentrated commercial feeding stuff, as here used, shall not include hays and straws, the whole seeds nor the unmixed meals made directly from the entire grains of wheat, rye, barley, oats, Indian corn, buckwheat and broom corn. Neither shall it include wheat, rye and buckwheat brans or middlings, nor pure grains grounds together, nor wheat bran or middlings mixed together or with other feeds.

SEC. 3. The term concentrated commercial feeding stuff, as here used, shall include linseed meals, cottonseed meals, pea meals, cocoanut meals, gluten meals, gluten feeds, maize feeds, starch feeds, sugar feeds, dried brewer's grains, malt sprouts, hominy feeds, cerealine feeds, rice meals, oat feeds, corn and oat chops, corn and oat feeds, ground beef or fish scraps, mixed feeds, provenders, and all other materials of a similar nature not included within section two of this act.

SEC. 4. Before any concentrated commercial feeding stuff, as defined in section three of this act, is sold, offered or exposed for sale, the importer, manufacturer or party who causes it to be sold or offers it for sale within the state of Vermont, shall, for each and every feeding stuff bearing a distinguishing name and trade mark, file with the director of the Vermont Agricultural Experiment Station a certified copy of the statement named in section one of this act, and shall also deposit with said director, at his request, a sealed glass jar or bottle containing not less than one pound of the feeding stuff to be sold or offered for sale, accompanied by an affidavit that it is a fair average sample thereof and corresponds within reasonable limits to the feeding stuff which it represents in the percentages of protein and fat which it contains.

SEC. 5. The manufacturer, importer, agent or seller of each concentrated commercial feeding stuff as defined in section three of this act, shall, before the article is offered for sale, pay to the director of the Vermont Agricultural Experiment Station an in-

spection tax of ten cents per ton for each ton of such concentrated feeding stuff sold or offered for sale in the state of Vermont, and shall affix to each car shipped in bulk and to each bag, barrel or other package of such concentrated feeding stuff, a tag, to be furnished by said director, stating that all charges specified in this section have been paid. The director of said experiment station is hereby empowered to prescribe the forms for such tags, and adopt such regulations as may be necessary for the enforcement of the law. Whenever the manufacturer or importer or shipper of a concentrated feeding stuff shall have filed the statement made in section one of this act and paid the inspection tax, no agent or seller of said manufacturer, importer or shipper shall be required to file such statement or pay such tax. The amount of inspection tax received by said director shall be paid by him to the state treasurer. So much of the inspection tax collected under this act shall be paid by the state treasurer to the treasurer of said experiment station as the director of said experiment station may show by his bills has been expended in performing the duties required by this act, but in no case to exceed the amount of the inspection tax received by the state treasurer under this act, such payment to be made quarterly upon the order of the auditor of accounts. who is hereby directed to draw his order for such purpose.

SEC. 6. Any manufacturer, importer, agent or person selling, offering or exposing for sale any concentrated commercial feeding stuff, as defined in section three of this act, without the statement required by section one, and the tax tag required by section five of this act, or with a label stating that said feeding stuff contains substantially a larger percentage of either of the constituents mentioned in section one than is contained therein, shall on conviction in a court of competent jurisdiction be fined not more than fifty dollars for the first offense, and not more than one hundred dollars for each subsequent offense.

SEC. 7. All manufacturers and importers of concentrated commercial feeding stuffs, or dealers in the same, shall, when requested, furnish the director of the Vermont Agricultural Experiment Station with a complete list of the names or trade marks of said feeding stuffs, and all agents selling, offering or exposing the same for sale.

SEC. 8. The director of the Vermont Agricultural Experiment Station shall cause one analysis or more to be made annually of each concentrated commercial feeding stuff sold or offered for sale under the provisions of this act. Said director is hereby authorized in person or by deputy to take a sample not exceeding two pounds in weight for analysis from any lot or package of cencentrated commercial feeding stuff which may be in the possession of any manufacturer, importer, agent or

dealer in this state; but said sample shall be drawn in the presence of said party or parties in interest, or their representative, and shall be taken from a parcel or number of packages which shall not be less than five per cent. of the whole lot inspected, and shall be thoroughly mixed and then divided into two equal samples and placed in glass or metal vessels, carefully sealed, and a label placed on each stating the name or brand of the feeding stuff or material sampled, the name of the party from whose stock the sample was drawn, and the time and place of drawing, the said label shall be signed by the director or his deputy and by the parties or party in interest, or their representative, present at the drawing and sealing of said samples; one of said duplicate samples shall be retained by the director and the other by the party whose stock was sampled, and the sample or samples retained by the director shall be for comparison with the certified statements named in sections 1 and 4 of this act. The result of the analysis of the sample or samples so procured, together with such additional information as circumstances advise shall be published in reports or bulletins from time to time.

SEC. 9. The director of the Vermoat Agricultural Experiment Station shall notify the State treasurer of all violations of this act, and the State treasurer shall commence a suit in the name of the State against the party or parties thus reported. It shall be the duty of the treasurer, upon ascertaining any violation of this act, to forthwith notify the manufacturers and importers, in writing, and to give them not less than thirty days thereafter in which to comply with the requirements of this act. But there shall be no prosecution in relation to the quality of any concentrated commercial feeding stuff if the same shall be found to be substantially equivalent to the statement of analysis made by the manufacturers or importers.

SEC. 10. The term importer, for all the purposes of this act, shall be taken to mean all who procure or sell concentrated commercial feeding stuffs.

SEC. 11. All acts or parts of acts inconsistent with this act are hereby repealed.

SEC. 12. This act shall take effect July 1st, 1899.

Approved November 29, 1898.

No. 84.—AN ACT TO PREVENT FRAUD IN THE SALE OF GARDEN SEEDS.

It is hereby enacted by the General Assembly of the State of Vermont:

SECTION 1. Every package of garden seeds offered for sale in the State of Vermont shall have the year in which they were grown plainly printed thereon.

SEC. 2. Any person who offers for sale any garden seeds contrary to the provisions of section 1 of this act, or who puts a false date on any package of garden seeds, shall be fined not less than ten dollars for each offense.

SEC. 3. This act shall take effect on the first day of July, 1899.

Approved November 29, 1898.

REPORT OF THE SECRETARY.

To the Chairman and Members of the Board of Agriculture of the State of Vermont:

Herewith I submit the following report of the work of the Board for the year ending June 30, 1899:

The Board were unable to organize until December 16th, 1898, therefore some time was lost in arranging for the customary winter meetings. The Board being less in numbers than in previous years, it was thought advisable to call to our aid men from within the state of practical experience in different lines of farming, fruit growing, fish and bee culture, the heads of the different departments of the State Agricultural College, and also for one week, Col. J. H. Brigham, Assistant Secretary of the Department of Agriculture, Washington, D. C., assisted the Board.

Meetings have been held in all the counties with the exception of Grand Isle, and in that county arrangements are perfected whereby a meeting will be held during the coming August.

The following is a list of the towns and dates of meetings, together with the names of the speakers and their subjects which were used more or less during the season:

FARMERS' MEETINGS.

Enosburgh Falls	January 12 and 13
Jericho Center	January 17 and 18
Hinesburgh	January 19 and 20
Shoreham	January 24 and 25
New Haven	January 26 and 27
Dorset	January 31 and February 1
Mount Holly	February 2
Pittsford	February 3
Guilford Center	February 7 and 8
South Londonderry	February 7 and 8
Sharon	February 9 and 10
Bradford	February 9 and 10
West Waterford	February 16
Wheelock	February 16 and 17
Newport Center	February 21 and 22
Albany	February 22 and 23
Wolcott	February 23 and 24
North Tunbridge	February 28 and March 1
Middlesex	March 2 and 3
Marshfield	March 2 and 3
Canaan	March 8 and 9

Col. J. H. Brigham, Assistant Secretary of Agriculture, Washington, D. C.—"Suggestions for Ambitious Boys :" "The Department of Agriculture and what it is doing for the farmer."

Prof. J. L. Hills, member of board,—"Economical Dairy Foods ;" Improving Dairy Products ;" "What the Experiment Station has done and is doing ;" "Some of the New Ideas in Agriculture :" "The State Agricultural College, Its Work."

J. K. Curtis, member of board—"Silos and Silage ;" "Farm Barns ;" "Grasses, Clover and Soiling Crops :" "The Grass Crop."

C. J. Bell, member of board—"Farm Machinery and Labor ;" "Maple Sugar Manufacturing ;" "The Co-operative Creamery :" "Farm Work."

C. F. Smith, Morrisville—"The Eye, or What we See ;" "Feeds and Feeding ;" "Nineteen Years Experience and Observation on a Vermont Farm ;" "Butter Making :" "Silos and Silage."

Ernest Hitchcock, Pittsford—"Farm Barns :" "Building up a Dairy Herd."

Prof. J. W. Votey, Vermont State Agricultural College—"Vermont Highways," (illustrated by a Stereopticon.)

Prof. L. R. Jones, Vermont State Agricultural College—"Grasses and Weeds :" "Potato Blights and Remedies."

G. H. Terrill, Morrisville—"The Dairy Cow—How to Breed, Care for and Feed Her ;" "Farm Fertility and How to Increase It :" "Fruit, Bees and Vegetables a side issue."

O. J. Lowery, Jericho—"Bee Culture."

T. L. Kinney, South Hero—"Commercial Fruit Growing."

D. H. Morse, Randolph—"Can the Farmer be too Practical?" "The Grass Crop :" "Hiring and Managing Farm Help."

J. P. Hall, Isle La Motte—" Propagation and Production of Apples ;" " Fruit Growing."

Cassius Peck, Superintendent of the State Agricultural College Farm.

Frederick V. R. Day, South Londonderry—" The Farm, the Ranch and the Hacienda."

G. T. Shanks, South Londonderry—" Beautifying the Home."

A. C. Cudworth, South Londonderry—" One Vermont Crop."

W. L. Gibson, South Londonderry—" Theoretical vs. Practical Farming."

D. D. Wait, South Londonderry—" Does Farming Pay?"

Rollin W. Whitney, Springfield—" Farm Economy."

John E. Gale, Guilford—" Business Method on the Farm :" " A Garden Talk."

Dr. F. A. Rich, Vermont State Agricultural College—"Tubercolosis."

S. J. Hastings, Waterford—"Dairying and Care of Stock."

A. W. Hastings, Waterford—"Hens."

J. W. Titcomb, U. S. Fish Commissioner, St. Johnsbury—"A Talk on Fish" (illustrated by a stereopticon.)

G. S. Fassett, Enosburgh—"The Dairy Cow."

M. S. Stone, State Superintendent of Education—"The Education of the Farmer."

Dr. J. C. Campbell, Albany—"Why should the Farmer be interested in the Board of Agriculture?"

E. S. Brigham, St. Albans—"Home Mixing of Fertilizers."

Dr. J. H. Hamilton, Secretary State Board of Health, Richford—"Sanitation."

Albert Bliss, Marshfield—"Fertilizers."

S C. Pike, Marshfield—"Dairying."

Dr. T. R. Styles, member State Board of Health, St. Johnsbury—"Sanitation."

Prof. G. H. Perkins, Vermont State Agricultural College—"The Forest Worm."

Most of the meetings were held two days, beginning in the afternoon of the first day. The program was carried out with one exception, the meeting called at West Fairlee, February 14 and 15 was postponed on account of the storm of the 13th, which much delayed all trains and the only communication the Board were able to have with that town was by telephone from White River Junction.

The attendance and interest in the meeting were good.

It was the intention of the Board to procure some local speakers at every meeting; this, however we were unable to do in many places, but it is our opinion that much good can be done by such assistance, and we may look more for such help in the future.

The leading industry among the farmers of Vermont at the present time is dairying. How to produce more pounds of butter at a less cost per pound is always an interesting question. The creameries and cheese factories are becoming quite numerous in the State, as will be noticed by the list in the Dairymen's Association Report. These factories help to make a much better average product, with less labor attending it in the farm house; and at a less cost to manufacture and market, to the dairyman.

There are creameries and cheese factories in fully one-half the towns in the State; one town, at least, having four in successful operation.

Estimated by the returns that have been received, 18,000,000 pounds of butter was manufactured by about 150 creameries which were in operation the full year at a cost of about 2⅔ cents per pound to manufacture, paying to the patrons full 19 cents per pound net. This does not include the largest creamery in the world, which manufactured 2,500,000 pounds of butter.

About 5,000,000 pounds of cheese were made at the factories. Several factories furnish only cream which is expressed daily to the markets and the amount of milk shipped is increasing year by year.

Maple sugar, one of our valuable products, has suffered greatly during the past year. The crop the last season was much below the usual amount, caused partly by the ravages of the forest caterpillar, which defoliated many forests last year and continued their work in new sections this year.

AGRICULTURAL FAIR SOCIETIES AND ASSOCIATIONS.

Following will be found a list that are working in the interests of agriculture. There are some Farmers' Clubs that meet quarterly or annually, but I am unable to furnish any list.

Cattle Commission—The work of the Board as Cattle Commissioners will be found under a separate head.

C. J. BELL,
Secretary.

East Hardwick.

ASSOCIATIONS.

State Agricultural Society—President, George Aitken, Woodstock; Secretary, Henry Clark, Rutland (deceased); Treasurer, J. Walter Parker, Quechee.

Vermont Dairymen's Association—President, George W. Pierce, Brattleboro Secretary, F. L. Davis, No. Pomfret; Treasurer, P. W. Strong, No. Pomfret.

Vermont Maple Sugar Makers' Association—President, Alpha Messer, Rochester; Secretary, A. J. Croft, Enosburgh Falls; Treasurer, V. I. Spear, Randolph.

Vermont Jersey Cattle Club—President, Homer W. Vail, North Pomfret; Secretary, T. G. Bronson, East Hardwick; Treasurer, N. L. Boyden, Randolph.

The Vermont Merino Sheep Breeders' Association—President, Ira L. Hamblin, Middlebury; Secretary, Lewis A. Skiff, Middlebury; Treasurer, Lewis A. Skiff, Middlebury.

State Horticultural Society—President, T. L. Kinney, So. Hero; Secretary, F. A. Waugh, Burlington; Treasurer, F. A. Waugh, Burlington.

Vermont Botanical Society—President, Prof. Ezra Brainerd, Middlebury; Secretary, Prof. L. R. Jones, Burlington.

Vermont Bee Keepers Association—President, R. H. Holmes, Shoreham; Secretary, M. F. Cram, West Brookfield; Treasurer, H. L. Leonard, Brandon.

Green Mountain Cotswold Sheep Association—President, Frank Phillis, Glover; Secretary and Treasurer, A. A. Niles, Morrisville.

Vermont Shropshire Sheep Association—President, Geo. H. Terrill, Morrisville; Secretary and Treasurer, A. A. Niles, Morrisville.

OFFICIAL DIRECTORY, VERMONT STATE GRANGE, PATRONS OF HUSBANDRY. 1899.

OFFICERS.

Master—C. J. Bell, East Hardwick.
Overseer—C. F. Smith, Morrisville.
Lecturer—R. B. Galusha, Jericho.
Steward—D. H. Morse, Randolph.
Assistant Steward—M. B. Roberts, Rupert.
Chaplain—O. J. Lowrey, Jericho.
Treasnrer—F. B. Pier, Rawsonville.
Secretary—A. A. Priest, Randolph.
Gate Keeper—A. F. Lawrence, St. Johnsbury.
Ceres—Mrs. C. J. Bell, East Hardwick
Pomona—Mrs. C. F. Smith, Morrisville.
Flora—Mrs. R. B. Galusha, Jericho.
Lady Assistant Steward—Mrs. M. B. Roberts, Rupert.

Executive Committee—Alpha Messer, Rochester; W. L. Park, Lyndon; I. T. Story, Essex; F. H. Spaulding, W. Brattleboro; Master and Secretary, *ex-officio*.

OFFICERS OF POMONA GRANGES.

Number of Grange, Name, Officers and Office, P. O. Address.

1. Chittenden County—F. W. Ayers, Master, Essex Center; Mrs. M. E. Galusha, Lecturer, Jericho; F. W. Garvin, Secretary, Essex Center.

2. Shepherd—L. W. Grey, Master, Waterford; Mrs. P. C. Houghton, Lecturer, Kirby; E. H. Hallett, Secretary, St. Johnsbury.

3. White River Valley—C. C. Whitney, Master, East Bethel; Austin Bugbee, Lecturer, Sharon; Mrs. J. W. Bailey, Secretary, Royalton.

4. Allen District—E. F. Whitcomb, Master, Springfield; C. A. Greeley, Lecturer, Chester; Mrs. Ella G. Howe, Secretary, Rockingham.

5. Windham County—W. E. Banks, Master, Brattleboro; Mrs. Ella Eames, Lecturer, Brattleboro; Mrs. A. A. C. Ware, Secretary, Brattleboro.

7. Central Vermont—Henry Kibbee, Master, North Randolph; A. B. Manchester, Lecturer, Randolph; Mrs. May C. Kibbee, Secretary, North Randolph.

8. Washington—Eugene Smith, Master, Pawlet; Porter Sherman, Lecturer, W. Rupert; J. W. Sheldon, Secretary, Dorset.

OFFICERS OF SUBORDINATE GRANGES, 1899.

1. Green Mountain, St. Johnsbury Centre—B. A. Farnham, Master; G. C. Willey, Lecturer; Mrs. G. C. Willey, Secretary.

9. Caledonia, East Hardwick—W. L. Dow, Master; J. A. Kidder, Lecturer; E. B. Fay, Secretary.

16. Enterprise, Lyndon—W. N. Hubbard, Master; Mrs. Fred Spencer, Lecturer; Mrs. J. C. Allbee, Secretary.

22. Protective, Brattleboro—Carl S. Hopkins, Master, Western Avenue; Mrs. M. J. Currier, Lecturer, Frost St.; Mrs. M. J. Sargent, Secretary, Box 484.

23. Independent, Wheelock—Bradley Ingalls, Master, Sheffield; Mrs. H. P. King, Lecturer, Wheelock; Mrs. A. F. Emerson, Secretary, South Wheelock.

53. White River, Royalton—J. F. Shepard, Master, South Royalton; Mrs. J. F. Shepard, Lecturer, South Royalton; S. A. Waldo, Secretary, South Royalton.

66. Wide Awake, St. Johnsbury Centre—S. R. Learned, Master; Miss Ida Learned, Lecturer; Miss Ida M. Lyford, Secretary.

80. Middlesex, Montpelier—L. A. Flint, Master; J. W. Maxham, Lecturer; G. I. Cummings, Secretary.

81. Williamstown, Williamstown—Frank Martin, Master; Mrs. Hattie Granger, Lecturer; Mrs. Lena Briggs, Secretary.

83. Orion, S. Woodstock—E. A. Fullerton, Master; Mrs. S. A. Fullerton, Lecturer; P. C. Kendall, Secretary.

87. North Branch, Worcester—H. T. Kellogg, Master; M. P. Kent, Lecturer; Mrs. A. G. Stearns, Secretary.

93. Snowsville, E. Braintree—W. H. Perham, Master; Jennie Smith, Lecturer; K. H. Howard, Secretary.

98. Brookfield, Brookfield—C. S. Williams, Master; Mrs. Lucy Tracy, Lecturer; Sophia E. Follansbee, Secretary.

114. Springfield, Springfield—Chas. F. Cluff, Master; B. W. Brown, Lecturer; Bertha Whitcomb, Secretary.

117. Grafton, Grafton—Solon Cummings, Master, Houghtonville; J. W. Davis, Lecturer; Mrs. A. J. Davis, Secretary.

118. West River, Townshend—G. H. Houghton, Master; Mrs. F. L. Osgood, Lecturer; Mrs. A. A. Snow, Secretary.

127. Industrial, Andover—S. P. Carlton, Master, Simonville; Clara H. Smith, Lecturer, Chester; C. M. Gutterson, Secretary.

128. Williams River, Chester—A. C. Greeley, Master, Chester Depot; Mrs. Wm. H. Johnson, Lecturer, Gassetts; C. A. Greeley, Secretary.

129. South Branch, Chester—E. A. Edson, Master; Mrs. Linna Baldwin, Lecturer; Mrs. Mary L. Warner, Secretary.

131. West Branch, Landgrove—L. F. Woodward, Master; Mrs. L. A. Woodward, Lecturer; Mrs. Ella Fenn, Secretary.

137. Farmers, So. Londonderry—L. O. Wilbur, Master; Mrs. Mary M. Wilbur, Lecturer; S. O. Davis, Secretary.

138. Mountain Home, Bondville—H. L. Benson, Master, Rawsonville; F. B. Pier, Lecturer; S. B. Taylor, Secretary.

139. Vermont, Wardsboro—Mrs. A. L. Howard, Master; Mrs. Ella Knight, Lecturer; Mrs. S. D. May, Secretary.

142. Floral, Sharon—H. C. Bruce, Master; Mrs. E. H. Noyes, Lecturer; Mrs. Carrie M. Bugbee, Secretary.

151. Broad Brook, Guilford Center—F. R. King, Master, Guilford; Mrs. J. R. Jaqueth, Lecturer; L. B. Bullock, Secretary.

154. Evening Star, Dummerston—Edwin H. Brown, Master, East Dummerston; Angie B. Reed, Lecturer, East Dummerston; Emma R. Lynde, Secretary, Brattleboro.

155. Essex Center, Essex—F. W. Ayers, Master; Mrs. I. Wilbur, Lecturer; Mrs. F. A. Bellows, Secretary.

156. Maple Grove, Westminster West—Joseph P. Ranney, Master; Harlan Goodhue, Lecturer; Anna C. Clark, Secretary.

157. Boyden, Westminster—J. W. Collins, Master; Eva M. Bachelder, Lecturer; O E. Peck, Secretary.

158. Middle Branch, East Bethel—H. P. Riford, Master, South Randolph; Miss L. L. Paine, Lecturer, South Randolph; A. P. Paine, Secretary, South Randolph.

159. Dog River Valley, West Berlin—W. E. Colby, Master; Mrs. W. E. Colby, Lecturer; Marcia Libbey, Secretary.

163. Guiding Star, West Halifax—Eli S. Cooke, Master; W. W. Burnett, Lecturer; Mrs. Ira Larrabee, Secretary.

164. Victory, Wilmington—Clark Chandler, Master; Darter Fitch, Lecturer; F. S. Bellows, Secretary.

165. North River, Jacksonville—W. H. Hancock, Master; W. S. Allen, Lecturer; Mrs. A. J. Faulkner, Secretary.

170. Mount Mansfield, Underhill—A. C. Humphrey, Master; Mrs. A. C. Humphrey, Lecturer; C. H. Hayden, Secretary, River Side.

228. Vernon, Vernon—A. J. White, Master, Dummer; F. E. Johnson, Lecturer; Ellen M. Reed, Secretary.

229. West Randolph, Randolph—A. A. Priest, Master; G. H. Slack, Lecturer; Miss Gertrude Hart, Secretary.

230. Mount Anthony, Rupert—J. F. Sheldon, Master; M. B. Roberts, Lecturer; Earl Sheldon, Secretary.

231. Dorset, Dorset—Mrs. H. E. Snyder, Master; Mrs. L. A. Sheldon, Lecturer; J. H. Sheldon, Secretary.

233. Lamoille, Morrisville—W. M. Small, Master, Morristown; Mrs. Levi Gile, Lecturer; Mrs. H. J. Edmunds, Secretary.

235. Chittenden, Williston—W. H. Metcalf, Master, North Willistown; M. W. Clark, Lecturer; Mrs. W. H. Metcalf, Secretary.

236. Johnson, Johnson—F. F. Jones, Master; O. H. Wilson, Lecturer; Mrs. O. H. Wilson, Secretary.

237. Waterbury, Waterbury Center—James Thurston, Master; Mrs. E. B. Moody, Lecturer; Henry Hill, Secretary.

239. Westford, Westford—John E. Allen, Master; Mrs. J. E. Allen, Lecturer; W. W. Kimball, Secretary, Brookside.

240. Neshobe, Brandon—Wm. H. Dean, Master; Arthur H. Gipson, Lecturer; Marion E. Seager, Secretary.

241. Fairfax, Fairfax—A. D. Ufford, Master; Effie Wheeler, Lecturer; Mrs. R. A. Southard, Secretary.

242. Pleasant Valley, Rockingham—Eugene P. Weston, Master, Bartonsville; Grace L. Burt, Lecturer, Bartonsville; Leon A. Weston, Secretary.

244. Memphremagog, Newport—J. B. Spires, Master; Mrs. A. A. Lane, Lecturer; Charles Briggs, Secretary.

245. Burlington, Burlington—M. A. Maynard, Master; B. S. Barrett, Lecturer; G. F. Patch, Secretary.

246. Newport Center, Newport Center—W. R. Connal, Master; Mrs. W. R. Connal, Lecturer, F. P. Miller, Secretary.

247. Rising Star, Bethel—E. E Spaulding, Master; Bell Chamberlin, Lecturer; Mrs. Fannie M. Waldo, Secretary.

249. Woodlawn, West Milton—Arthur Morgan, Master; B. F. Gale, Lecturer; Laura A. Allen, Secretary,

251. Clover, East Fairfield—R. Sturtevant, Master; Miss Anna L. Spoffard, Lecturer; E. A. Sturtevant, Secretary.

252. Sutton, Sutton—L. W. Gordon, Master; S. S. Doud, Lecturer; Myra Gordon Secretary.

253. State Line, South Vernon—E. A. Pratt, Master, W. Northfield, Mass.; Mrs. F. A. Adams, Lecturer, W. Northfield, Mass.; Mrs. E. C. Eames, Secretary, W. Northfield, Mass.

254. Silver Leaf, Fairlee—W. C. Woodward, Master; Miss E. Closson, Lecturer; Mrs F. G. Holmes, Secretary.

255. Eclipse, Thetford—F. M. Bond, Master; Mrs. M. S. Dunham, Lecturer; Grace A. Slafter, Secretary, East Thetford.

257. Missisquoi Valley, Troy—D. A. Ball, Master; Miss Florence A. Ball, Lecturer; Miss E. Agnes, Maloney, Secretary.

259. Vershire, Vershire—Will Wetherbee, Master; Mrs. G. B. Drake, Lecturer; G. E. Stacy, Secretary.

260. Clover Leaf, Bradford—W. E. Young, Master; Mrs. W. G. Coburn, Lecturer; Gustaf Kruslock, Secretary.

261. Pulaski, Newbury—Sidney Johnson, Master; Miss Laura Chamberlin, Lecturer; A. W. Silsby, Secretary.

262. Mayflower, So. Fairlee—L. B. Morse, Master; Alice R. Haven, Lecturer; Isa M. Ordway, Secretary.

263. Blue Mountain, Ryegate—George C. Nelson, Master; Miss Jennie Meader, Lecturer; Irving H. Gilfillan, Secretary, South Ryegate.

265—Passumpsic Valley, Passumpsic—S. J. Hastings, Master; Mrs. C. R. King, Lecturer F. S. Shepard, Secretary.

266. Pleasant Valley, W. Waterford—E. P. Carpenter, Master; Mrs. E. M. Ladd, Lecturer, St. Johnsbury; Edna E. Hovey, Secretary, St. Johnsbury.

267. Marshfield, Marshfield—M. E. Bemis, Master; Mrs. Mary Spencer, Lecturer; Miss Flora E. Bemis, Secretary.

268. Washington, Washington—J. B. Seaver, Master; —— —— ——Lecturer; M. E. Dickerson, Secretary.

269. Craftsbury, Craftsbury—C. B. Cole, Master; J. A. Gallagher, Lecturer; S. R. Lathe, Secretary.

270. Maple Valley, Albany—J. B. Rogers, Master; H. E. Carter, Lecturer; F. H. Pierce, Secretary.

271. Irasburg, Irasburg—O. G. Page, Master; Mrs. J. H. Cook, Lecturer; C. H. Woodward, Secretary.

272. Glover, Glover—Hiram N. Davis, Master; Annie L. Gray, Lecturer; Nora L. Phillips, Secretary.

LIST OF FAIRS, STATE OF VERMONT, 1899.

State—Vermont State Fair, Billings Park, White River Junction, September 12-14. President, George Aitkin; Secretary, G. W. Hoffman.

Part of County.—Northern Caledonia Fair Association, Lyndonville, Sept. 6, 7. President, C. D. Hubbard; Secretary, E. McGinnis.

World—Springfield Agricultural Society, Springfield, September 5, 6. President, L. M. Cragin; Secretary, Frank D. Gill.

Town—Ryegate and Wells River Dairymen's Association, South Ryegate, August 30, 31. President, George W. Darling; Secretary, F. J. Tewksbury.

Local—Bradford Fair, Bradford, last week in August.

Local—Orwell Fair, Orwell, date not fixed.

Local—Waits River Valley Agricultural Association, East Corinth, last week in August. President, Rev. W. E. Hatch; Secretary, Warren Craft.

World—Howard Park Association, Burlington, September 12-15.

County—Rutland County Fair, Rutland, September 19-21. President, J. H. Mead; Secretary, Willis Ross.

Town—Brandon Fair, Brandon, date not fixed. President, H. R. C Watson; Secretary, C. E. Savery.

Local—Western Vermont Agricultural Society, Fair Haven, September 19-22. President, B. H. Norton; Secretary, E. N. Northrop.

World—Union Agricultural Society, Tunbridge, October 3-5. President, J. K. Taning, Chelsea; Secretary, Wallace W. Swan, North Tunbridge.

Local—Dog River Valley Fair, Northfield, September 19-21. President, J. B. Wells; Secretary, W. W. Holden.

Local—Winooski Valley Fair, Waterbury, September 12-14. President, Eugene Moody; Secretary, M. C. Evans.

County—Windsor County Agricultural Association, Woodstock, September 26-28. President, Fred L. Davis; Secretary, J. S. Eaton.

County—Addison County Agricultural Society, Middlebury, September 5, 6 and 7. President, C. M. Remele; Secretary, C. S. Dana.

County—Franklin County Fair, Sheldon.

County—Lamoille Valley Fair, Morrisville, September 5, 6 and 7. President, G. W. Hendee; Secretary, A. A. Niles.

County—Orleans County Fair, Barton, date not fixed. President, Homer Somers; Secretary, D. D. Beane.

Local—Caledonia Grange Fair, East Hardwick, October 7. President, W. D. Bronson; Secretary, E. B. Fay.

County—Caledonia County Fair, St. Johnsbury, September 19-21. President, Truman R. Stiles; Secretary, Fred E. Harriman.

N. E.—Valley Fair, Brattleboro, September 27-28. President, G. W. Hooker; Secretary, Clarence Stickney.

Local—Battenkill Valley Industrial Society, Manchester Center, August 29, 30 and 31. President, E. B. Smith; Secretary, D. K. Simonds.

BUSINESS METHODS ON THE FARM.

By JOHN E. GALE, Guilford, Vt., at Farmers' Meeting at Wheelock, Feb. 16, '99.

While it is not my purpose to engage in any general adverse criticism of the business methods of our farmers, yet I have found that there are different ways of doing things, and although I do not profess to have found the best methods, yet I have reason to believe that I have improved upon those of some of my acquaintances, and perhaps a little discussion upon the subject may be beneficial to us all, even though no strictly new ideas are advanced, for all of us are more or less forgetful and need to be waked up occasionally.

The farming industry is the greatest business of this country, and of the world, yet I believe that farmers as a class are more unbusinesslike than any other great class of people known to the business world, and I believe this to be due largely to the fact that while the farmer has made great improvement in his methods of tilling the soil, and caring for his crops and his flocks and herds yet he has not given a proportionate amount of care to the improvement of his business methods.

If one who had made no preparation for that work should undertake to practice medicine, you would not expect him to be very successful, and if one who had served no apprenticeship in the mercantile business should undertake to run a store you would expect him to compromise with his creditors after a year or two at the most. Yet how many there are who engage in farming and expect to make a living, who have only a general idea of the business, and no special training, such as would be regarded as indispensable in any other business in order to make a success of it.

In one respect farming is the best business in the world, for it will stand more abuse and still give a man a better living than any other business under the sun.

Now, I am going to talk to you a little while about carelessness. You may say that this does not properly appertain to my subject, but I claim that carelessness is unbusinesslike, and therefore comes within my jurisdiction. Carelessness causes more loss, destroys more property every year than robbers, thieves and war. By carelessness I do not mean ignorance, I mean a heedless disregard of those duties which we know should be attended to, a reckless oversight of those circumstances which we know to exist and demand our attention. There

are many defects of management which I shall include under the general head of carelessness. The man who is careless in one thing will be heedless in other things, and will be successful in his business in proportion as he mends his ways and not otherwise.

I know a man who always turns his cattle into his pasture in the spring before he mends his fences, and he never gets around to mend them until after the cows get out of the pasture and that man spends five times as much time every summer in running after his cows, as would be needed to put the fences in good condition before the cows were turned out.

Speaking of fences, I consider it to be gross carelessness to build a barbed wire fence without a good strong pole on top. I am no friend of barbed wire and have never used it except where every other strand was smooth.

To return to my subject, it is careless to have a loose scuttle in a stable, or barn floor. By a loose scuttle I mean one which is not hung on hinges, but is liable to be left out of place or become misplaced by the foot of some animal, and result in the loss of a cow or a horse. I have known of various instances of this kind, and the loss is always laid to "bad luck." Another aid to bad luck is the storing of grain and feed in open boxes, or in barrels without covers. Let your grain be kept in a box or chest that cannot be upset, and have a lid hung on hinges, and have it understood that that lid is to be kept shut at all times, except when feeding or when putting in grain.

And keep your stable doors shut, the year round. Provide for ventilation, but not by way of the stable doors. One of my neighbors has a meal room where he keeps his grain in open boxes. The door to this meal room is usually open, and the door from the barn floor to the stable is usually open. Since my recollection he has lost two of his best cows, and spoiled a third by their getting loose in the stable, going through two doors, both of which ought to have been kept shut, and into the meal box, which ought to have been covered up. All this was laid to bad luck, and when the worms eat up his currants and the bugs destroy his potatoes, or the crows pull his corn, or his squashes freeze up, or his evaporator burns down, all this is due to bad luck. All these things have happened to him and others beside. He is worth less by at least $2,000 than he was fifteen years ago, yet he has always worked hard, been strictly temperate and not extravagant in any way. His lack of success is due to carelessness and unbusinesslike methods.

Carelessness and kerosene lanterns make a bad combination. You remember how the widow O'Leary set her lantern down in the cow stall, and the cow kicked it over and burned up a great part of the City of Chicago. Lanterns have caused

many a sudden rise in real estate, still we don't care to see our property go up in that way. *Don't* set a lantern down when it is lighted ; always hang it up—not on a nail, but on a hook or snap. A good hook answers the purpose and is most convenient, so have a hook put up in every place where you are likely to want to use a lantern. Be careful with the lantern. It is a treacherous servant. There is fire enough in it to destroy all you have accumulated by your hard work.

If you were to ask me what I regard as the greatest hindrance to business success, I should say the credit system. The cash customer can invariably get better terms than he who buys on credit. Now let us see what this means. If you buy phosphate, for instance, it is to be paid for by November 1st, but if you settle July 1st you get a discount of five per cent. That is, you save five per cent. by paying three months earlier. This means twenty per cent. per year. Can you afford to pay this rate? If you *will* buy phosphate pay cash for it, if you have to borrow the money. No matter how good your credit may be, you will always get better rates by paying cash. Your farm machinery, implements, grain, groceries—everything that you buy will cost you from 5 to 25 per cent. less if you pay cash. Don't buy on the installment plan ; it seems easy, but it is too expensive. If you must have something that you can't pay for, borrow the money at a fair rate, and get the benefit of the cash discount. Pay for one thing before you buy another, you will then be more careful about buying something that you don't need, and if some smooth-tongued agent comes along and wants to sell you something that you had never thought of before, don't listen to him. He wants your money. If you really want a set of lightning rods, or a cook stove or a cream separator or a patent umbrella, buy one, but don't buy it to accommodate any agent.

The merchant buys at wholesale and sells at retail. He makes a profit on his sales. He makes his living that way—supports his family, pays his clerks, his rent, his taxes, all his bills and expenses, and perhaps lays up money—out of his profits. Who pays them? And why? Why should not the farmers of every neighborhood combine and buy their grain, their machinery, their fertilizer, their flour, sugar and all other staples at wholesale and save from 10 to 40 per cent. that now goes to support the merchant? Is it businesslike to continue this waste? Think of this. There is much to be learned by close observation. Watch two classes of men, the successful and the unsuccessful. The failures of the latter will be as valuable to you as the improved methods of the former.

By the successful farmer please understand that I mean one who has achieved success upon the farm, not some wealthy man who has taken up farming as a pastime.

The balance sheet between profit and loss is often heaviest on the wrong side by reason of waste. It is waste to pay two hired men when you need but one, or to pay one when you don't need any. It is waste to keep cheap help around. Don't do it. If you need a hired man get one who will earn good wages. Don't waste your time. I know a man whose mortgage is as heavy as it was ten years ago, and whose farm is no better than it was then. He has always been to town with his butter twice a week when once would have done as well. This means a loss of 26 working days or at least $50 per year for the whole time. During that time he has kept one more horse than he had any use for, which means another $50 a year wasted. His stable manure has been without a roof over it, and his hogs and fowls kept in a cold, uncomfortable place. This means another $50 a year wasted. The result is that bad luck has been continuously on his trail, and his future prospects are not encouraging.

Don't rely too much on astrology, mythology, or other spook management. I have never known a successful farmer who allowed the moon to regulate his farming operations, yet I have known those who would not kill a hog, or plant beans, or take a young calf away from the cow unless the moon was just right, or the "sign" where it ought to be. Some are afraid of Friday, and some of the number thirteen. I tell you that Friday is one of the best days in the week, and I would rather have thirteen dollars in my pocket any day than to have twelve. Let the man in the moon manage his own farm and we will take care of ours. If the sign is not right when you get ready to butcher, burn up your almanac, and go ahead. There is no such thing as luck. Good luck is but the reward of industry and care, and bad luck the logical result of carelessness and bad management. As a matter of business, if you offer anything for sale let it be neat and attractive in appearance. See that the eggs are clean—wash them if need be; see that the potatoes are free from dirt, that turnips and beets are free from roots, and that leaves and pieces of bark do not get into the barrels of apples. See that the tops of your syrup cans are screwed down tight, and that the outside of every can is washed clean. If your maple product is to be shipped away crate it in neat boxes of planed wood. The nice clean package makes a pleasing impression upon the customer. And do not depend upon a lead pencil or cards tacked on for addressing your packages. Get a separate-letter stencil from your hardware dealer, and with it you can set up any name or address and change it at your pleasure. It will come handy for marking blankets, bags and

many other things, and will last a life time if your neighbor does not borrow it and forget to bring it home.

Now I want to talk to you about the farm accounts and correspondence. How many farmers know exactly what they are worth? or whether they are making or losing? How does the merchant manage about this? He takes an inventory every year. Now let me advise all of you who have not already done so, as soon as may be after this meeting is over, to take an inventory of everything that you own. Make a complete list of everything of value that you possess. Put the figures where they belong—don't let them lie to you. This inventory is going to be for your own information and not for publication, nor for exhibition among your neighbors, so put down everything at what you judge it to be actually worth in dollars and cents. Appraise your farm, your horses, your cows, hay, grain, wagons, tools, machines, household effects, money, notes and bills due you—everything that has a money value. And then make another list of your liabilities. Set down everything that you owe. Strike the balance and see what you are worth. Keep a record of this inventory in your account book, and next year when the first of January comes around you will have it to refer to, and can make the new inventory with very little trouble.

Keep an account of all your business transactions. An ordinary two quire ledger is just the thing for the small farmer. This places four columns before you. If you charge up a bill, set it in the first column; if you receive cash, set it in the second column of the left hand page, and if you get trusted set the amount in the first column, and if you pay cash set it in the second column of the right hand page. Fix up your book every night, regularly, and foot up at the end of every month. At the end of the year square it all up, collect what bills are due you and pay those that you owe. Look over your year's account and see where you have spent money foolishly, you may learn something. When you buy your account book get also a pad of bill heads and a letter file. When business-like men pay bills they want a receipted bill, and it is a very easy matter to make out a neat bill upon the printed blank. There are various kinds of letter files, but the Springfield file costs only 25 cents, and answers every purpose. It will hold all your letters for a year or two, all arranged in alphabetical order where you can turn to them on a moment's notice. Don't destroy your letters, keep them where you can find them. It may mean dollars to you.

Don't keep much money about you. Put it on deposit in some national bank and make your payments by check. You then avoid possibility of loss and have a receipt for every bill you pay. Every time you draw a check balance up on the stub so that

you know exactly how your account stands. Remember that wise and valuable advice, "Lose not thine own for want of asking for it; 'twill bring thee no thanks," and also the scriptural admonition, "Be not one of those who go as sureties for debts."

SOME OF THE NEWER IDEAS IN AGRICULTURE.

By JOSEPH L. HILLS.

The agriculture of to-day is in many respects notably different from that of former generations. This truism is of course applicable to nearly all lines of human endeavor. The farmer of to day who conducts his operations as did his ancestors is almost as far behind in the race for success as he who would run an old fashioned stage-coach in competition with a good railroad line. To be a successful farmer one must study the newer methods of agriculture whether he will or not.

It is quite impossible for me in the space of a few pages, to give any full treatment of modern agriculture. It may not be impossible for me, however, to throw out a few disjointed hints concerning some of the newer ideas which have come into vogue in agricultural operations through our better knowledge of the underlying principles of the art.

SCIENCE IN AGRICULTURE.

I think that we may properly say that one of the most important advances in agriculture of late years lies in the fact that farmers have begun to appreciate that there is something to book-farming. Go back twenty-five years and you will find but few believing that there was anything to be learned from books, from teachers, from science or from college education in farming lines. There are all too many to-day who sneer at what they are ready to term theory ; but those who are nearest up-to date, who are most advanced, who are most successful, most studious, most thoughtful, always admit that they do not know it all, that there is something they can learn from others. This marked change of opinion has been wrought not by a single agency but by several which have served to uplift the farming community. The agricultural press, farmers' clubs of divers classes, the agricultural colleges, the experiment stations, farmers' institutes and the like have all done an important part in this general movement. All of these agencies serve to bring to the individual the experience, the knowledge and the ideas of many. Thus far most of these have been concerned simply in what might be termed an instructional effort. It is the duty of one of them, however, not so much to instruct as to inquire, not so much to tell what is already known as to find out that which is not known. This duty devolves upon the experiment station.

The situation which confronted these stations at the time of their birth required a large amount of instructional effort upon their part. This has not prevented, however, much investigational work, and even within the eleven brief years of their life much has been accomplished. The agricultural press and the institute speaker lean more heavily to-day upon the experiment station and look more to its work and depend more upon what it does than upon any other one source of agricultural information.

A large share of what I shall have to say in the remainder of my remarks will be based upon the work of these experiment stations in this and other countries.

SOIL.

When I was attending the Agricultural College of Massachusetts, twenty odd years ago, I was taught a good deal about the chemistry, and something about the geology of the soil. The professor had something to say, moreover, touching the physics of the soil, but not a word did he utter which indicated that biology had any connection with such matters. Chemistry teaches us the composition of soil; geology, the origin of them in far back ages; physics, the action of matter when it is massed together; while biology is the science of life. Hardly any of us dreamed at that time that the soil was as truly alive as we were ourselves. There has been of late years, however, a great advance in our knowledge of certain physical characteristics of our agricultural soils, as well as of the minute beings, more particularly of a plant nature—the bacteria—which inhabit the soil. We have not time at present to go into the minutiæ of this matter, and I simply bring up one or two examples.

I presume that it would be safe to say that if the farmers of this State were asked why they cultivated their corn patches they would answer that it is to kill the weeds. The killing of weeds is really, however, a very secondary consideration. Weeds (in moderation) are often a blessing, because their presence forces farmers to cultivate the land. The primary object of tillage is the saving of water. When we consider that a corn plant uses in the course of the season, for every pound of dry matter it contains, three hundred and twenty-five pounds of water, we get some idea of the enormous call the plant makes upon the soil for this important constituent. If the soil is not too porous or the season too dry, the crop will often get nearly this amount of water. Let the season be in the least dry, however, or the soil not retentive of moisture, this full amount of water may not be available. The inevitable result of a lessened water supply is a smaller gross yield to the acre. The amount of water available to the growing plant is

probably more important than any other one factor, and methods of getting this water to the plant are well worth considering. Our western brethren do this by irrigation. Many of us can well afford, even in these humid regions, to consider whether such procedure is not after all advisable. Each and every one of us, when running a cultivator, is watering his plants just as truly as if he were playing a hose upon them or were bringing the water to them in an irrigation ditch. How is this possible? It is because the soil particles form themselves naturally into irregular fine tubes and the water of the soil passes up through these tubes by what is known as capillary attraction, in just the same manner as the oil climbs the wick when a lamp is lighted. Let a hot sun beat upon the soil or a scorching wind sweep over it, if that soil be not stirred to break up these fine capillary tubes, the effect will be just the same as when the lamp is lighted. The heat of the lamp draws up the oil; the heat of the sun or the wind draws the moisture from the soil and it is lost. Let the cultivator, however, break these tubes and form an earth mulch on top of the soil, the vaporization is materially hindered, the water collects about the level of the roots and there is much greater opportunity for the plant to do its best.

Turning now to the biology of the soil we find bacteria both helpful and hurtful in all soils. It behooves us to study something of their nature, mode of action, etc., that we may the more readily aid those that help us and hinder those that harm us. Among the helpful bacteria are those which are found in connection with the leguminous or pod bearing plants, like the clovers, beans, peas and the like, which enable them through a peculiar united life to gather nitrogen from the air. Thanks to these bacteria, this class of plants becomes a nitrogen trap, enabling the farmer to increase his store of this expensive element at relatively little cost. Again, other forms of bacteria nitrify organic nitrogen. If barnyard manure, for instance, be applied to a soil, or, we will say, a commercial fertilizer containing cottonseed meal or dried blood as a source of nitrogen, the nitrogen contained therein would be absolutely useless for plant purposes were it not that certain bacteria attack it and transform it from the organic state to that of ammonia; then, their work finished, a second set of bacteria take up the work and transform the ammonia to nitrous acid; and, following them, a third set changes the nitrous acid into nitric acid. This, in combination with certain basic elements, is fit food for plants and enters the root for use. Still other bacteria are mischief-makers and reduce these nitrates, which may be called the prepared and digested plant food, to their constituent elements—they undo the work of the nitrifying bacteria. It behooves us to study these various things and learn how we can best control

them. The methods and means, however, are too complicated for discussion here.

FERTILIZERS.

Among the modern notions touching fertilizers, may be cited the idea of fertilizing by feeding, of the sale of farm produce with reference to the fertilizing constituents it takes from the farm, and the notion of co-operative buying and home mixing in the purchase of commercial plant food. Fertilizing by feeding means essentially buying or raising such classes of animal food as are rich in fertilizing constituents. The animal that is feeding does not take all or even half the fertilizer ingredients from the food. Unless it be a growing animal, or unless the milk is taken from the farm, almost all of the fertilizing ingredients pass into the manure, and may be, if properly handled, placed upon the land. This is usually the best way of getting nitrogen, phosphoric acid and potash. One gets two services for one expenditure—buy both food and fertilizer with the same dollar. And, moreover, the fertilizer is for most purposes quite as good as much that is bought in other ways. The sale of farm produce with due reference to the fertilizing ingredients it contains, is worthy of consideration. A ton of butter takes but a few cents worth of plant food from the farm ; a ton of hay, from five to eight dollars worth. There are plenty of tables published showing the analysis of various farm products, and one can study for himself and determine what is wise to sell and what is not.

Regarding the purchase of commercial fertilizers, it may be said in brief that the ideas broached in this volume under the head of "Home Mixing," by Mr. Brigham, of St. Albans, are entirely sound. Any farmer who now makes a hap-hazard choice of commercial fertilizers writes himself down as either ignorant or careless. If he prefers for any reason, as most people do, to buy mixed goods, there is no reason why he should buy solely upon the basis of a name and agent's claim. The grade of the various goods sold in the State is thoroughly fixed, and the publications of the experiment station upon this point are sufficiently clear so that " he who runs may read." Buying goods on special order has much to recommend it to those who prefer to buy mixed goods rather than crude stock. Farmers, individually or collectively, get figures from several firms on definite amounts of fertilizers of guaranteed composition made from specified crude stock. They buy of the concern whose bid is lowest and pay for just the amount of plant food delivered as found on analysis by the experiment station. It is an eminently business-like method of purchase, fair to both parties, and one which many manufacturers are willing to adopt.

FORAGE CROPS.

A very large share of Vermont farmers are dairymen. Every one of them has a barn, more or less well equipped for the winter feeding of his stock. They all labor in summer, sowing, cultivating and harvesting crops for winter use. A large share of them carry, to all intents and purposes, dry cows only in the winter, working hard all summer simply to keep the cows alive during the winter while they are bringing in little or no income. These same men, however, often take no thought of means of summer feeding of cows. They depend solely upon the pastures. It happens all too frequently, however, that the pastures dry up and the cows shrink seriously in their milk flow. It is a difficult thing to turn the tide backwards. A cow once shrunk in milk seldom regains her former yield, and then with difficulty. It seems the part of wisdom for the farmers to divert some of the energy which they now devote to the growing of food for the maintenance of dry cows to the growing of food for keeping the milk flow during summer. The larger use of soiling crops, such as oats and peas, hungarian, rowen and the like, is well worth while. Considerable amounts may be grown without very great expenditure of time or money, and they are excellently well adapted to help out a short or dry pasture.

There is, perhaps, nothing better for this purpose than silage. It has been very thoroughly demonstrated that a pound of digestible dry matter can be placed in the cow's manger by way of the silo cheaper than in any other manner. The silo capacity of a dairy farm should be made large enough, in my judgment, to enable one to use silage all the time. The silo intended for summer use, however, should be deep and with a relatively small surface area, to avoid what otherwise might prove to be large losses owing to fermentation. The stave silo is now coming rapidly into vogue, and is proving so very useful for most purposes, and is so readily put up and comparatively so inexpensive for its tonnage capacity, that it is to be hoped that the number of silos in Vermont will rapidly increase in the near future.

STOCK FEEDING.

One of the modern notions, although perhaps not so modern as some of those I have been advancing, is that the science of stock feeding is worthy of consideration. The more experience accumulates, both of the scientific or practical nature, the more we are inclined to think that the old German standard proposed in the middle of the sixties for the feeding of the milch cow, is not far from truth. Later investi-

gation has modified the figures to some extent, but the general proposition still stands. Akin to this matter, although perhaps not directly connected with agriculture, is the idea that there is such a thing as a balanced ration for mankind. Those who have been in a position to know, conservatively estimate that there is more sickness caused by errors of eating than by the use of intoxicants. It has also been clearly demonstrated that the human ration is frequently out of joint, not well balanced, that there is too much of the heat producing and too little of the flesh forming ingredients. One of the marked advances in the experiment station work of late years, has been the light it has thrown upon human nutrition.

DAIRYING.

There are a good many modern notions in connection with dairying, which, if time permitted, would be well worth considering. So large a share of this volume, however, is given over to matters connected with dairying that it hardly seems worth while to bring them in here. A good many of the ideas that are broached in connection with the article by the present writer, published in the Dairymen's Report in another portion of this volume, under the heading "What can New England do to Compete with the West in Dairying," would be pertinent in this connection, and the reader is referred thereto. It may be well enough to say, however, in brief, that, above everything else in dairying, the modern notions lay stress upon cleanliness as a great factor of success.

In closing, the writer may once more remark that this article is of necessity, because of its character, more or less sketchy, superficial, fragmentary. It is simply meant in a general way to call attention to certain of the more salient advances in modern agriculture. It by no manner of means even begins to exhaust the list. It would be possible to fill this entire volume with a discussion of matters which would be entirely proper under the present title and which ought to prove helpful to Vermont farmers. No one, however, need remain in ignorance of these more modern ideas, unless he himself deliberately elects so to do. There are now, as was said at the outset, so many different agencies working toward the uplifting of the farmers, intellectually and socially, and they are either free or available at so slight a cost, that all may use them who will.

THE DAIRY COW, HER CARE AND FEED.

By GEO. H. TERRILL, Morristown, at a Meeting of the Board of Agriculture at Albany, February 22.

Here is the foundation of the whole dairy business, for upon the cow more than any other one thing, depends our success or failure in the dairy work upon our farms, and upon our success as dairymen depends, to a great degree, (for many of us at least) our success as business men and home makers.

Much depends upon the care and feed bestowed, but with the best of care and feed we cannot make a cow with a capacity of 125 pounds per year a source of profit. And without profit we have nothing to improve our farms, beautify our homes and educate and encourage those who come after us.

How are we to get this profitable dairy cow? Not always by going out and buying a registered herd for I realize that many of us cannot do this for want of means. But improve the herds we now have first by selection. Use a Babcock tester and scales and you will be as much surprised as I was by this method, to find the cow you supposed to be one of your poorest one of your best and *vise versa*.

If you cannot buy a tester take the milk to the creamery for a few months once a month and have it tested. But be careful in taking your sample to pour the milk back and forth in the pails several times and then at once take out a pint jar full for sample before it has time to settle.

Multiply the test by the number of pounds and add 15 per cent for churn gain and you will easily know what your cows are doing. Sell to the butchers any you may chance to have that are unprofitable, for you are better off to milk and care for less, and have only those that pay a profit, for the work and feed bestowed upon them.

When you have thus disposed of the unprofitable ones, get a thoroughbred sire of the dairy breed that suits you best, which in these times can be bought within the means of any man who is able to keep ten cows.

Buy an old bull if you can that has proven himself to be a good sure sire and able to transmit his likeness to his progeny, and the better he will do this, the more valuable he is as a dairy sire. Many times breeders have used a superior animal until, to

avoid inbreeding, they are willing to sell it at a low price, even a beef price. The older animal will get better calves and keep much easier than a young one, for they will take oats and rough fodder that the young one will not thrive upon, and when you are through with him, if well fed, you can sell for beef or to some one else for a breeder, and so get your money back with compound interest compounded every time you raise a heifer calf.

If you cannot get an old bull, buy a calf and raise it. Be sure you get a good sire of a true dairy breed, of the true dairy form, not a thick-thighed, straight-horned beef type, but a dairy type, with large stomach, heavy body behind, tapering towards the front like a wedge, with long slim neck and broad head and intelligent eyes, soft silky yellow skin, broad, open ribs, well cut up behind, showing plenty of room for udder. When you have such an animal out of a cow with large square, well-placed udder with good teats, and tracing back for several generations of equal merit you are sure to improve. Follow this method and save and raise all the heifer calves you can, milk one season and weed out the poorest, and you are on the road to successs—yes, a macadamized road over which you will soon be driving a herd of 300 pound cows instead of the 125 or 150 pound herd you started with.

CARE OF THE COW.

We will begin with the calf and grow her up to a cow. First, I practice giving them their mother's milk three days then half of this and half skim-milk, warm from the separator for a week, gradually working down to all milk from the separator at three to four weeks old.

I then add a little linseed or fine feed, a spoonful at first until they eat hay well, then feed only hay, milk and ensilage in preference to meal for you want to train the young cow to grow and develop a large stomach with digestive organs capable of handling large quantities of coarse food, without putting much fat on to her body. It is milk you want her to make for you not beef or fat. This is why I feed new milk when young to develop strong digestive organs and not to weaken them by scours and sickness. Keep them growing and breed them to come in at two years old. Two weeks before they are due to calve I begin to feed them (old or young) a little bran and sometimes linseed meal and potatoes to have them gaining flesh and their bowels loose and healthy. For I don't care how fleshy a cow is, I want to be sure she is gaining flesh when she comes in and my experience proves almost without exception that if gaining flesh she with discharge her afterbirth and come

on all right, while if growing poor she is liable to have trouble.

If she has dropped her calf, give her warm drink for a few days at least. (I do all the time in cold weather). Increase her bran and linseed. If her udder cakes give 1 to 1½ pounds Epsom salts, 1 pint molasses, 1 ounce ginger. If this does not relieve give 20 drops tincture acconite two or three times a day. Bathe udder in hot water. Give the best hay you have and ensilage if you have it, if not get it as soon as you can. If ever you keep a cow well, do it the first ten days after calving, not with corn and cottonseed meal, but with cool and loosening feed.

I believe that much depends on this first ten days, for once you get them up to a large flow of milk you can keep them up easier and the time to do it is at the start of their milk flow.

Feed, water, salt, and milk regularly. They are creatures of habit, and if you are regular with them they will be regular with a large pail of good milk for you. You will find them ready and waiting for you everytime you come and the less you disappoint them and keep them waiting for you, the better they will respond to your wants, and fill your purse with shining gold. Give them warm quarters and if the old barn is cold, batten it up with boards and straw till you can make it permanently better. Keep the cows bedded and clean and you will not only grow proud of their looks but proud of their products and of the better price you are able to get. It does not pay in any sense to sell the fertility of the farm mixed with your milk and butter. If they reject any feed take it out and feed them less till they will eat it all every meal. Study each one's wants and cater to them. Care for them as well and as carefully as you can in your circumstances. Care for them like mothers and not like an automatic machine left to run itself, and their increased product will repay you many times for your painstaking care.

Last but not least and in no sense an unimportant part of the dairyman's work is the feed. The coarse feeds such as hay, ensilage, peas and oats and corn stover, are usually produced easily upon the farm, and I believe we should produce all our feed that we can upon the farm and thus save sending our hard earned money west. But many of us are so situated we have to buy some if not all of our grain feed. When we buy we should not buy the same elements we already have in our coarse feeds, namely carbohydrates or fat and heat producers, but buy protein in the form of bran, cottonseed, gluten and linseed and so balance the feed you already have and furnish what the cow needs not only to maintain herself but also maintain yourself and family.

The grass and clover are our main dependence for coarse feed but the corn plant is gradually working her way up well to the front in the esteem of the best dairymen in the state as a milk producing plant and when cured in the form of ensilage is first among our feeds for the economical production of milk in winter. Our hay crop to be the most profitable for growing cattle and producing milk must be cut early. Yes, cut earlier. Why don't we as dairyman wake up to this very important fact of our business. Early cut hay contains more protein or milk producing ingredients and the longer it stands after it is headed the less protein there is in it, as well as less milk and flesh, and the more meal we shall need to buy to make it a perfect ration. But even with this early cut hay we need a good supply of ensilage to go with it to make the cows do their best. Yes, you want ensilage for it is a great boon to the winter dairyman. It is like grass in that it is succulent and helps to keep their bowels loose and healthy. A boon to winter dairymen, I said, and winter dairymen is what we all ought to be. Don't lay down your work five or six months in the year, for no business can stand that and be profitable.

Have your cows come in so as to give an equal amount of milk and butter the year around, then you not only have something to do, but something coming to pay expenses every week in the year.

Strive to make your feed as palatable as possible, change occasionally if you can for like yourself they like a change ; these things all help them to eat more food and so give more milk.

Weigh your hay, ensilage and meal and know what it costs you per day to keep your cows and what they produce and so know about your business and whether it pays you or not. Apply business methods, figure out your ration, put the same amount of business into your work that you would to succeed in a store, a manufacturing industry or anything else and you will receive a profit greater in proportion to the money invested and risk taken, than in any other line of employment you may choose. Why then should we be complaining of our lot and of our condition when it is just what we make it, either a constant burden and trouble to ourselves and others or a comfort, yes, the noblest, purest, highest, and grandest work that God has given to man. Then let us brighten our countenances and show to all who know us that we are a happy contented class and looking after our interests as well as we can in our condition, striving to better it by education and thought and so grow as God would have us to be, noble dairymen and dairywomen.

ADDRESS BY COL. J. H. BRIGHAM.

Assistant Secretary Department of Agriculture, Washington, D. C., at Bradford, Feb. 10, 1899.

Mr. President and Gentlemen of the Convention :

The work of the Department of Agriculture has become so extensive that it is impossible to treat of it in detail on this occasion, but I will try to give you a general idea of what we are seeking to accomplish.

Our desire is to make the Department of Agriculture valuable to the American farmer and we are laboring earnestly in many directions for the accomplishment of this purpose.

Last year the total appropriation for the department was $3,509,202. This year Congress has increased that amount by $127,000. This appropriation is divided among two bureaus and about twenty divisions, having a total of 2,812 employes. The largest branch of the department is the Weather Bureau service, which receives $1,022,472 of the appropriation and gives employment to 1,195 persons at various points in the United States and in the recently established stations in the West Indies.

Next in point of importance is the Bureau of Animal Industry, having an appropriation of $950,000 and 1,050 employes.

The Division of Statistics has 136 employes and an appropriation of $110,000 ; the Division of Publications 66 employes and $80,000 appropriation. Various other divisions with the amounts appropriated for maintaining them and the number of employes are as follows :

Division of Botany, $28,800 ; 21 employes.
Division of Entomology, $29, 500 ; 21 employes.
Division of Pomology, $16,000 ; 12 employes.
Division of Seeds, $130,000 ; 34 employes.
Biological Survey, $27,560 ; 16 employes.
Division of Vegetable Pathology, $26,500 ; 15 employes.
Division of Chemistry, $32, 300 ; 22 employes.
Division of Soils, $16,300 ; 10 employes.
Division of Agrostology, $18,100 ; 18 employes.
Division of Forestry, $48,520 ; 12 employes.
Gardens and Grounds, $30,500 ; 28 employes.
Section of Foreign Markets, $15,000 ; 4 employes.
Road Inquiries, $8,000 ; 4 employes.
Office of Experiment Stations, $45,000 ; 33 employes.

In all of these bureaus and divisions the most expert help to be found is employed. Each division is presided over by a man distinguished in his particular line for his wide knowledge of the work in which he is engaged.

I will endeavor to give you as briefly as I can some idea of the work carried on in these various divisions of our Department. The Weather Bureau is of more importance to the farmer than may appear at first. This service has been and is being greatly extended and improved. Within the past few months stations have been established in our new possessions in the West Indies and the Bureau has been enabled to give timely warnings of a number of very destructive storms, thus saving an incalculable amount of money to shipping. In connection with the reporting of weather conditions, the Bureau also receives telegraphic reports of the condition of crops in various localities and the effect the weather has had or may have upon them. These reports are tabulated and sent out to the agricultural and daily press all over the country. You can readily see that in this manner the Weather Bureau is of great service to the farmers, for it enables them to judge of crop conditions in other sections of the country than their own and gives them an idea of the probable price they will receive for their products.

The Bureau of Animal Industry is doing some very valuable work. Its most important service to the farmer is the inspection of meats. This work has given consumers both at home and abroad confidence that our meats offered for sale are free from disease, and has enabled us to dispose of our large surplus at good prices.

Efforts are constantly being made to discover effective remedies for diseases of livestock. A dip has been perfected that will remove from infested cattle all fever ticks, making it practicable to ship them North at any season of the year. The value of this is almost beyond computation, as it enables stockmen south of the quarantine line to market their herds at any season of the year, and as the demand for fine beef at home and abroad is constantly increasing, this removes one of the impediments to its production. Experiments have been made with an antitoxin serum for the prevention and cure of hog cholera, with the result that it has been practically demonstrated that this remedy will save a great percentage of animals that are attacked by this disease. In the experiments made by the Bureau, eighty per cent of the animals treated were saved, while a like per cent of the herds not treated died.

It is the opinion of the Department that there is but little profit to the farmers in shipping grain to foreign countries. We believe it would be far better to convert the same into meats and dairy products and ship them to foreign markets in that

form. With this end in view the Department has made careful inquiries into the conditions of the markets of Europe and Asia and has sent agents to those countries to introduce our products to the consumers there. From the information thus obtained we are satisfied that good markets can be obtained for any surplus that we are likely to produce.

Reliable crop reports are very important to farmers. They should know, without depending upon commercial agencies, something about the crops in their own country and in other countries in competition with them, in order that they may judge of the probable prices for their surplus. The Department is undertaking to do this work in an intelligent manner, and we think we are succeeding.

We believe that the farmers have suffered from unjust discrimination against our products in some foreign countries, and that the claim made by those countries that these products are not healthy or safe for human consumption is simply an effort to prevent them from coming into competition with the home producers. The Department has therefore asked for legislation authorizing an examination of foreign products shipped to this country with a view, if this policy is continued abroad, of adopting some effective measures to put a stop to these efforts to exclude our products on false grounds.

In the Division of Botany attention is being given to many things that will prove beneficial to the farmer. Through their efforts chicory-growing has been encouraged so that the farmers of the western states are now able to produce all of that article we need, whereas in 1896 we imported 16,317,888 pounds.

The Division of Entomology has been quite successful in discovering means for checking the ravages of insects which annually do damage to our crops. The gypsy moth, the Mexican cotton-boll weevil, the chinch bug, the Hessian fly and the San Jose scale are some of the insect pests which have received special attention.

The Division of Pomology of our Department is accomplishing much good work, and is ready at all times to render assistance to the fruit-growers of the country.

Experiments made under the direction of the Department in the raising of sugar beets have clearly demonstrated that we can produce at home all the sugar needed by our people.

The Department is co-operating earnestly with agricultural experiment stations, agricultural colleges and all agricultural associations having for their object the advancement of the interests of agriculture. The farmer is often forced to compete with adulterated and imitation articles sold as the genuine products of the farm. Some legislation has already been secured for the protection of the honest producer, and the influence of the Depart-

ment will be brought to bear to secure the enforcement of all laws enacted and can be counted upon to assist in procuring other legislation that may be needed.

The Seed Division has been of considerable advantage to agriculturists, distributing many millions of packages of vegetable and flower seeds and also introducing many varieties of foreign seed procured by experts sent abroad, some of which will no doubt thrive in the United States and prove of value to the farmer.

All the other divisions of the Department are extending and improving their work so as to make it of the greatest possible benefit to the farmer. The Biological Survey is engaged in mapping out the natural life zones of the country ; the Division of Vegetable Pathology in hybridizing and improving the quality and flavor of our fruit and vegetables ; the Chemistry Division in studying soils and fertilizers for the same, and, in connection with the sugar beet investigation, is analyzing beets and determining areas where the beet can be profitably grown. The Soils Division is making an investigation of the physical properties of soils and their relation to crop production ; the Division of Agrostology is engaged in studying the most profitable grasses for various sections of the country ; The Forestry Division, the best methods of preserving our forests ; the section of Foreign Markets in procuring information and publishing useful bulletins on our trade with other countries and the Office of Road Inquiry is inquiring into the problem of how best to improve our roads.

We fully realize that the Department of Agriculture exists to-day because the farmers believed it possible for such a department to render them valuable service, and I assure you that it is the determination of those having the direction of the work to make it as valuable as possible to agriculture. We know that anything we can do to aid the farmer will be indirectly an advantage to all those who depend upon him for the means to sustain life and enjoy its comforts. We trust that you will feel that the Department is your friend and that you will make suggestions freely, and I assure you that they will be well received. We should be glad to have every farmer in the country visit the Department and investigate for himself the work that is being done. Recently a noted foreigner visiting our country came to spend three or four hours looking around the Department. He remained for several days and when ready to leave told the Secretary that he had seen nothing in this country in which he had become so interested as in the work of our department, and said further that there was nothing like it in any other country in the world. He predicted that if the people of the United States do not already appreciate the work being done the time would soon come when they would do so.

I have given you, as I am aware, but a brief outline of our work, but I invite you to read the bulletins and reports sent out and become familiar with this work in detail. If you will do this it will be encouraging to you as well as to us and be to our mutual benefit.

WHAT THE FARMER SHOULD DO FOR HIMSELF.

Address at Guilford, Feb. 8, by Col. J. H. Brigham, Assistant Secretary Department of Agriculture, Washington, D. C.

No class has contributed more to the comfort, happiness and prosperity of the whole people than the farmers. By their industry and perseverence they have cleared away the forests, drained the swamps, and turned the wilderness of America into a paradise, inhabited by the richest, strongest nation in the world. There is no country where the fruits of honest toil are more generally shared than in the United States of America. The annual product of the farms of our country is estimated to be worth $3,500,000,000—an amount of wealth which no mind can comprehend. We not only clothe and feed our people better than any people in the world, but we send abroad annually, a surplus sufficient to pay whatever balance there may be against us. Every legimate industry is dependent upon the success of the farmers. Manufacturers, merchants, professional men, transportation companies and the masses of labor all prosper when the farmers have been successful in their labors, and all suffer when partial failure makes hard times on the farm. The farmer has borne his share and more of the burdens of taxation; he has ever nobly responded to the call of his country in peace or in war. Whenever storm-clouds have gathered and our institutions have been threatened, the country has turned with confidence to the conservative, law-abiding, home-loving farmer, and every draft upon his patriotism has been honored.

Whilst the farmer will continue to contribute to the general welfare, it seems to me that it is very important that he should give some special attention to his own interest. In other words, he must learn to help himself. Must adopt business methods upon the farm. Must produce what the consumers want, and are willing to pay for. Must go to extremes in a few lines and neglect others. He must secure equal protection under the law an equal distribution of the burdens of taxation, a fair share of the honors distributed among our people and a fair share of the wealth produced by his intelligent efforts.

These desirable conditions will not come about by chance. It will require painstaking, persevering effort on the part of the farmer; it will be necessary for him to make available his power for the accomplishment of these ends. In other words, the farmers must learn to get together. They must organize asso-

ciations for the purpose of discussing all questions of interest to them and also for the purpose of devising plans to put in force the results of their deliberation.

It has become such a common thing for interests to unite in some form of organization that it seems hardly necessary to submit arguments showing the importance of organization among the farmers, and yet, very many of them do not seem willing to make use of this agency for the promotion of their own interests.

As a country, we have progressed wonderfully, until the estimated value of our visible property is more than sixty-five billions of dollars, a goodly portion of which represents the skill and industry of the farmer. Whether or not he has his fair share of this wealth is an open question. I find that the total value of all property in the United States, as given by the census returns, was as follows:

In 1850, $ 7,135,780,228.
In 1860, $16,159,616,068.
In 1870, $23,997,221,474.
In 1880, $43,642,000,000.
In 1890, $65,037,091,197.

This represents the tangible property as nearly as could be ascertained. The total capital invested in farming operations, consisting of land, fences, and buildings, implements and machinery and live stock, was as follows:

In 1850, $ 3,967,343,580, or 55.59 per cent. of the whole.
In 1860, $ 7,980,493,063, or 49.48 per cent. of the whole.
In 1870, $ 8,885,658,218, or 37. per cent. of the whole.
In 1880, $12,104,001,538, or 27.73 per cent. of the whole.
In 1890, $15,982,267,689, or 24.54 per cent. of the whole.

This statement shows, not that the capital invested in farm operations has decreased, for it has increased with each decade, but that the amount of capital invested in other lines of industry increases more rapidly than in the farming industry. This is not surprising, as the acreage of farming land is limited, and when it is all brought under cultivation and properly improved, furnished with implements for cultivation and with all the stock that it can profitably carry, capital will necessarily seek other fields of investment where there is more room for expansion.

The above statement does not pretend to give the actual wealth of those who are engaged in the various industries of the country. It only gives the capital invested therein. Much of this capital represents the accumulations of the farmers.

The real estate of this country in 1890, was valued as follows, valuations being "true" ones.

Real estate and improvements	$39,544,544,333
Mines and quarries, including product on hand	1,291,291,579
Railroads and equipments, including street railways	8,685,407,323
Telegraph and telephone lines, shippings and canals	701,755,712
Total	$50,222,998,947

There is a small element of personal property in this total, but to offset this there is some real estate that is omitted because it is impossible to ascertain its value from the census reports. The value of farm real estate is reported to have been $13,279,-252,649, which is but 26 per cent. of the total real estate value of the nation. The reported value of the real estate of the nation outside of farms in 1890, was $36,943,746,298 ; this is 57 per cent. of the wealth of the country. This real estate outside of farms is very largely situated in cities and towns, where it is gaining in value faster than it is possible for farm land to gain, (land has been sold in New York and London within a few years at the rate of several million dollars per acre), and I assume that it is partly due to this fact that the visible farm property constitutes a diminishing ratio to the wealth of the nation as time advances.

The persistent efforts to supply the market with imitation or adulterated food products is a matter of concern to the farmers as well as to the consumers of the country. We are aware of the fact that shoddy and other worthless articles are substituted in the manufacture of so-called woolen goods by which the demand for the product of the sheep is cut down and the consumer is swindled in the purchase of goods that are not what they seem to be. We are also aware of the successful efforts made by wealthy corporations representing large capital to shirk their fair share of the burdens of taxation. In all these matters the farmers are vitally interested and will suffer greatly unless some means can be devised to prevent these frauds. Farmers must unite in demanding effective legislation, state and national, and must send men to Congress and the Legislature who are in sympathy with honest, fair dealing in all these matters. They must also rally to the support of those who are charged with executing the law and sustain them in every contest with those who wilfully violate or disregard the law. If the farmers will not assist in fighting their own battles they need not expect other people to fight for them. Very many of the things of which we complain exist because we have permitted them to and because we have been apparently indifferent in the matter of protecting our own interests. If we desire a change for the better, we must bring it

about through our own efforts. If the farmers will make available their power and use it wisely for the proper protection of their own interests, there is nothing that is right which they may not demand and hope to accomplish. If they will not do so, they should cease complaining because of the inequalities of taxation and other wrongs from which they suffer. Self-help is the one thing needed by the farmers at this time.

The additions recently made to our possessions make it all the more important that the farmer should be in a condition to guard well every agricultural interest. It is not now a question of whether or not expansion is wise ; we have already expanded and the fortunes of war have placed new and important responsibilities upon our country, and the farmers must bear their share of this responsibility and act wisely and patriotically in meeting the same and especially see to it that no harm comes to the farmers of our own country in settling these important questions.

SILOS AND SILAGE.

By C. F. Smith of Morristown, at a Meeting of the Board of Agriculture, held in Shady Rill, Middlesex, March 2nd.

Some 18 or 19 years ago we read of the wonderful results that could be obtained by the use of ensilage. As dairying was our principal business, and as we were in circumstances that made it necessary for us to adopt all improved methods, after going a hundred miles to see a silo, we decided to build one. At that time wood silos were unheard of, but, as we had no means to build one of stone and cement, we built it in a part of the bay, putting on lath and covering with cement. We planted *ensilage* corn, a large southern variety. Some of it tasseled out. As it was very rainy the week we cut it, I think the silage (judging by the odor) must have contained about 110 per cent water. With our own experience, and the experience of others, obtained by reading good agricultural papers, we improved, year by year, upon the quality of our silage. We have tried rapid filling, slow filling, green corn, mature corn, frosted corn, partially dried corn and all varieties of corn. For our section, northern Vermont, we decided years ago that we could produce more pounds of milk from an acre of Sanford corn, a white flint, than from any other variety. The kind of corn should depend upon the location. Raise the largest variety that is reasonably sure to glaze before frost. The sweeter varieties are not as good for silage as they contain too much sugar. In this State most farmers build their silos in a part of their bays. If built in this way it will be necessary to put in strong girts as there is great lateral pressure, if the silo is deep. Take some pieces of plank, ten or twelve inches wide and about three feet long, saw out a circle, seven or eight inches deep at the middle. Place these in the corners and spike to the girts. It will make them stronger and the double boarding and tarred paper, which should be used between, can go around this circle, thus avoiding square corners. It is difficult to pack corn in square corners so there will be no poor silage.

While matched spruce has usually been used for the inside boarding, in this State, we believe good unmatched hemlock is better, because more durable. Where it is not too expensive, Georgia pine is doubtless the best to use, and in less frosty States one thickness of boarding would be sufficient. In warmer States the stave silo is undoubtedly the cheapest and best.

Three years ago we built a round silo at the end of the barn, where the silage would come in easily, taking the old ones for hay. This silo is 24 feet in diameter and 34 feet high, inside measure. A circle was sawed from a plank, doubled to break joints, and held in place upon the wall by rods which reach down into the stone and cement. The wall, about 18 inches high on the outside, is dishing on the inside, and the bottom is paved with stone and Portland cement to keep rats out. Two by four studding, placed 14 inches apart, was nailed to this 8 inch bottom circle and to a similar 4-inch circle at the top. Three lengths of studding were used, therefore one 8-inch and three 4-inch double circles. An inch hole was bored between each stud in the 4-inch circles, and when done, through the outside boarding, above the 8-inch circle. This is to take out the dampness between the boarding thus adding many years to the life of the silo. Four by eight studding, held by iron rods, was used where connection is made with the barn, for an opening to take out the silage. Short plank, lined with tarred paper to break joints, is used here as the corn is put in. The walls are double boarded, outside and in, with unmatched hemlock, sawed ¾x6 inches, planed on one side. The joints were broken every time around, on a different stud. Its strength is enormous, as every board acts like a hoop. Over 1,000 pounds of nails were used in its construction. Four thicknesses of paper were used, that between inside boarding being tarred. The outside is clapboarded. Jack Frost has never got through the walls. It cost about $500, but more expense was put into the jet and cupola than was necessary.

A building a few feet away, on about ten feet higher ground, with floor for cutter and power two feet above the driveway, and carrier from cutter to top of silo, makes it very handy in filling. Low racks, with the top about eighteen inches from the ground, are used for drawing. The corn is cut and bound with a McCormick harvester, which saves much expense in handling.

A very important part of the silo question is the cheapness with which the corn can be raised. We plow the ground in the late fall for two reasons. First, because we cannot plow so much in the spring and get our crops in as early as we like to; and secondly, our ground, being a heavy clay marl, if plowed in the fall, will harrow more mellow and be less lumpy, making a better seed bed. We spread some manure in November and December before snow comes, but more in early spring, using a Kemp spreader. A heavy clover sod will furnish a large amount of plant food for the corn, and together with a good dressing of stable manure, well preserved, will make the buying of much commercial fertilizer unnecessary.

Cultivation means a great deal. It means fertilization, as it liberates plant food and makes it available. It means no

weeds to steal and eat up the plant food that the corn should have. It means conserving the moisture, as by forming an earth mulch the water will pass up through the roots, stems and leaves of the plants.

For each pound's growth of dry matter that the corn plant makes, three hundred pounds of water has to pass through its roots, stock and leaves.

We start the Morgan spading harrow, the best pulverizer for our soil, as soon as the ground is sufficiently dry; and like to go over it three or four times, at intervals, before it is time to plant the corn. This warms and pulverizes it, and destroys many weed seeds that germinate. Going over it with a steel roller will pulverize and fine the lumps. A perfect seed bed is necessary. One man plants the corn with a two rowed planter, using about eight or nine quarts of seed per acre. It marks the middle of the next two rows so that the driver, by keeping the pole over the mark, can get them even and straight, thus enabling us to care for and harvest the corn much better. The rows are three and one half feet apart, and hills eighteen inches. We go over the corn twice with a Thomas smoothing harrow, the second time just as it is beginning to come up. Once in four to six days thereafter, until it is too large, it is gone over with a weeder. If a heavy rain packs the clay soil the weeder is preceded by a fine tooth cultivator.

Should the weeds, during several days of wet weather, get their heads above ground, we follow the fine tooth cultivator with Prout's tobacco hoe to smother those between the hills, by a shallow covering. These tools are used until the corn is two feet or more high. In this way clean fields can be had with no hand hoeing.

With corn raised on dry soil, when it is well glazed it is in the best condition for the silo. On our clay soil, the corn keeps green and contains a large amount of water until frost comes. We let it stand and grow until about frost time and then partially dry it. It makes better silage to be partially dried by frost than to be put in with too much water in it. Slow or rapid filling will not make sweet silage, but the right condition of the corn will. The sweetest and best silage we ever had was from corn cut the last of September, before frost, put up in large stooks and cut into the silo in about two weeks.

For covering the silage, any wet material, the finer the better, that will pack close and form an air tight covering, will be all right. For several years past we have not covered ours, but kept it well tread and fed from the whole surface every day, and like to feed it 365 days in a year. As a summer feed for our dairy to supplement the pastures, good silage is the most

economical and satisfactory of anything we ever had. The cost for labor, or plowing, spreading manure, harrowing, planting, running weeders, cultivators, etc., together with cutting it into silo, does not exceed one dollar a ton for our silage. About one-third of this is for harvesting.

DAIRYING.

By I. C. PIKE of Marshfield, at a meeting of the Board of Agriculture held at Marshfield March 3, 1899.

The subject of Dairying is one that interests a large proportion of the inhabitants of this state ; for by this business we get our living and something for a rainy day if we make it pay. But the question that we are constantly trying to solve is, how can we make it pay the largest amount? Certainly not by letting everything go haphazard, with no care or thought about the many little things connected with the business, such as feeding, breeding, caring for the stock, and the making and marketing of the product. There must be a great deal of care and good judgment exercised from first to last in order to be successful in this dairy business. It is sometimes said that anybody can run a farm, but we find that the ones that are the most successful in farming and especially in dairying are those that study the business. It takes brains to run a dairy and make it pay in these times of low prices for dairy products. A man must study to produce milk or butter at its lowest possible cost. He must raise on the farm everything he can to feed the cows, then he must purchase those feeds that will balance the feed he raises and produce the most pounds of butter fat for each dollar paid out. To do this intelligently, he must be able to compound rations that have certain amounts of each of the different kinds of nutrients, such as carbohydrates, protein, fat, etc., in the right proportions to produce the best results. The feeds that can be raised on the farm to the best advantage and the most profit, are clover, corn, oats, peas and grass. Early cut hay is the best for cows. Cut the last of June and the first of July, later will do for horses. The best way to harvest the corn crop is to put it into the silo ears and all if it is to be fed to cows. If one wants some for the pigs they can snap off part of the ears and husk and put into cribs. Corn ensilage is the best feed for cows that are giving milk I ever fed. Putting corn into the silo secures the crop with the least waste and in the best condition to feed. All kinds of stock like ensilage and thrive upon it, and it lengthens out the hay crop wonderfully. Oats and peas cut green and made into hay are good. Feed liberally, for the cow is our machine for converting rough feeds into milk. It takes a certain amount to sustain the life and

health of the animal, and what they can eat and make use of more than that goes to make milk or beef as the case may be. A half starved cow will not give much milk, neither will one that is shivering with the cold. Make the stables warm and comfortable, with good ventilation. The successful dairyman must have good cows, for it does not pay to feed poor ones. How can he get good ones? There are two ways. If he has plenty of money he can buy them, but most men will not sell their best cows unless they get a big price for them.

Another way, and I think the way, is to raise them from his best cows, using the best full-blooded sire he can find. To know which are his best cows he must use the scales and Babcock test or set the milk of each cow separately for a day or more at intervals and see just what each cow is doing. Weigh each cow's milk and test carefully and then he can tell which cows to raise calves from, which cows are paying a profit above their board, and which are boarding on him and running him into debt. Dispose of all cows that do not pay a profit. When the heifers become cows test them and dispose of all that are not first class. In a few years the cows will be much better than when the weeding process was begun. It seems strange that so many men will keep cows year after year and never know or even *try* to find out how much butter each cow produces. When I first began the business of dairying on my own account we had a mixed herd of natives, Durhams, Devons, and a little Jersey blood, which would produce about 150 pounds of butter each, yearly, on an average. I had read of some dairies that were making 300 pounds on an average, which set me to thinking what I could do to improve mine. It was beyond my means to sell my cows and purchase such cows as those, so I began testing what we had by setting some of the milk of each cow in glass tumblers and comparing the color and thickness of the cream. This was a very imperfect way of testing, but it was a starting point in securing the end in view. Next we set the whole mess of each cow for one day by itself and stirred the cream to see how much butter it would make and the quality of the butter as to its color, solidity, etc. This was a more satisfactory method than the first but was too much work and trouble to be done very often. This was before we had heard of the Babcock test. Now we use that and find it very convenient and accurate. It has been the means of a great improvement in the general average of production in our dairy. The past year we were determined to know just what each cow would do, so we weighed the milk of each cow at every milking through the year, and tested them at intervals with the Babcock test. Also we kept an account of each churning through the year so as to know just how much butter was made.

At the end of the year in figuring up we found that the amount of milk given by each cow ranged from 3931 pounds, the lowest, to 8075 pounds for the highest, with a test ranging from 4.20 to 6.60 with an average of 5.40 for the herd. In reckoning the amount of butter each cow made from these figures by the test, the one that gave the most milk made 471 pounds of butter, and the one that gave the least 165 pounds of butter. And let me say right here, this last cow I sold for just what I could get the first chance I had and she went to market. We milked 15 cows through the year, and seven of them gave over 400 pounds of butter each and four more over 350 pounds each ; average for the herd 368½ pounds. The eleven best averaged 420 pounds. By adding the amounts of butter estimated from each cow by the test and amount of milk given, and comparing with the amount of butter churned, we find that they very nearly agree. I have heard some men say that they thought it did not pay to feed cows much meal. To this I will say some will and some will not. If a man has cows that will not pay for a fair amount of the right kind of grain feed in connection with hay and ensilage or other rough fodders, he had better dispose of them to the butcher and get some that will pay for the feed given.

This last fall we tried a little experiment on this line. We were feeding about four pounds of grain to each cow, in connection with hay and ensilage, composed of two parts bran, one part gluten meal and one part cottonseed meal. We added two pounds to each cow's ration to see if they would pay for it. This extra meal cost me just twenty cents per day for the lot. After feeding a few days they made just forty cents worth more butter per day ; thus doubling my money on the extra feed. The past year the grain feed for each cow averaged $10.92, and the butter from each cow averaged $64.87, leaving a balance after paying for the grain of $53.95.

There are various methods of securing the cream from the milk, and we have tried them all, from the small pans to large ones, deep cold setting and farm separator. Now we use the separator set in a small room finished for the purpose in the stable, run by a tread power, which is the most satisfactory method of any we have ever tried. In using the separator we get more butter from the milk and with less labor than by any other way we have ever tried. I think it pays in dollars and cents if a man has ten or more cows, to purchase one, if he is going to make his own butter. Also the skim milk is in just the best condition possible to feed to calves and hogs. Being warm it saves the work of warming over the stove or other method. Then the cream is cleaner and purer and churns easily, and less butter fat is left in the buttermilk. If a man lives near the

creamery perhaps he had better carry the milk and have it separated there, but if two or more miles away, I think it would be better to have a separator and carry the cream to be made into butter, if not convenient to make it at home ; thus saving quite an item of expense in hauling so much milk to and from the creamery.

Another thing to be considered in connection with this business of which we have not spokem, is the skim milk which is fed to calves and hogs. This helps to swell the amount of cash, and fertilizers to keep up the fertility of the farm, as well as to increase the amount of stock on the farm and the capacity of the farm to keep more stock.

Perhaps some would like to know how we feed, if so I will say we feed a small amount of hay first in the morning, then milk. After breakfast we water the cows and clean the stables. While the cows are out we clean out the mangers and feed ensilage and grain, ready for them when they come in. Nothing more until night, when we feed another small feed of hay before supper. After supper we milk, then feed ensilage and grain.

In preparing this paper you will pardon me if I have had too much to say concerning my own experience ; for as I am no scientific man, but a plain practical one, there was not much I could say without speaking from experience, so I have left the theories and the scientific part for those who can do them justice.

BEE CULTURE.

By O. J. Lowry of Jericho, Delivered at a Meeting of the Board of Agriculture at New Haven, January 27th, 1899.

The apiarian industry of the United States is largely a development of the last 40 years. There was occasionally an individual engaged in this work long before that time. In the year 1869, according to the United States census report, this country produced 14,702,815 pounds of honey. We find that in the year 1889, according to the United States census, we produced 63,894,186 pounds of honey, and it was estimated there were 300,000 persons engaged in the production of honey.

Addison county takes the lead in honey production in Vermont and during the past two seasons it is quite certain that this county produced 200,000 pounds of honey each season. This means ten car loads of ten tons each, and it is quite evident there is no town in Vermont where bees could not be kept at more or less profit. If the honey of Addison county netted the producers 12 cents per pound, we find $24,000 of wealth added to one county, and all comes from what would go to waste, if not for bees to gather the nectar of the flowers. Thousands of dollars of sweet are annually going to waste in the State of Vermont for lack of bees. Intelligent action is necessary along this line, as well as in other branches of Vermont agriculture. If we need to use brains as well as muscle in the production of grain, milk and butter or in the production of fruit, we need also proper methods along the line of bee-keeping. A person in any business must have some love or taste for that business, or he is not likely to make a success of his calling. Close observation and study are necessary in bee culture. A person that keeps bees should know their habits and understand the flora of his locality. If we expect the honey flow to begin June 15th we should strive to have a large working force at the right time as it takes about 21 days from the egg for the worker bee to emerge from the cell and nearly or quite 14 days before these young bees go into the fields to gather honey. It will be clearly seen that our queens should be doing their very best at egg laying at least 35 days before the contemplated honey flow. Many do not seem to understand the great good the honey-bee

does in the fertilization of fruits and flowers, the fertilization of the clover blossoms especially, the white or Dutch clover, which, together with the Kentucky blue grass makes our finest pasture for growing stock. This clover is largely visited by the honey bees, and such visits of the bees in search of honey causes the plants by mixture of pollen to produce an abundance of seed, and in a moist season these seeds germinate, causing a greater amount of clover for our stock to graze upon; also in the promulgation of fruit many varieties would produce little or no fruit if not for the honey bee carrying the pollen dust upon its body and legs from blossom to blossom, from tree to tree.

It has been clearly proven by many of our leading entomologists that bees are a necessity in cross-fertilizing the blossoms of fruit crops. This is also proven from Press Bulletin 108 of the Kansas Experiment Stations, Manhattan, Kansas, which says if bees are kept from fruit blossoms by netting or other artificial means, the amount of fruit set is little or none. An insufficient supply of bees will hinder the setting of fruit. While other insects may take part in the carrying of pollen the fruit-raiser must rely chiefly upon honey bees.

When bees are very angry and elevate that portion of their bodies containing the sting you will often see a tiny drop of transparent liquid on the point of the sting. This liquid is the poison of the bee sting; it has a sharp, pungent taste, and one that tastes it or gets it in his eyes will soon conclude it is not so very strange that such a substance introduced into the circulation produces so much pain. The poison of the bee sting is claimed to be similar in composition to that of the viper. I think that no chemist has ever given us an analysis that would tell us just what the poison is. A person not used to handling bees and not acquainted with their habits, is liable to get many more stings than a person that is acquainted with the business. The person that has no knowledge of bees but wishes to learn, would do well to give his face at least some protection, and if stings are received never pull them out, thereby pressing the poison into the flesh, but rub them off, and the sooner the sting is rubbed or scraped off the better. Bees are less irritated by a person making quiet, easy motions, while manipulating the hives or handling the frames. While the veteran will get along with little or no protection in the apiary, the novice will find it more to his comfort, and more agreeable at times, to use ample protection.

Hives for the apiary should be simple, and accurate in construction. A plain box with frames, and as few other loose parts as possible, will yield in the hands of the skillful beemaster far better results than the most magnificent bee palace man-

ipulated by one who does not know the habits and requirements of bees. Hives should be made with proper bee space around the ends, top and bottoms of the frames ; the top and end space should not be over 5-16ths of an inch ; the bottom space, if the hives are not to be tiered, can be one-half inch ; if hives are to be tiered, some may prefer them flush with the bottom and have a rim for the hive to rest on. When used single, hives must be made so as to be easily manipulated, and the object sought of producing comb or extra nice honey should be considered in purchasing or selecting hives or frames for the apiary. Some beekeepers will provide a frame hive and then furnish no comb guide nor properly space the frames, and the bees may build the comb crosswise of the frames. Such hives are not one whit better than box hives ; frame hives managed with intelligence and skill are essential to the greatest success. The frame and hive most in use in this country was the invention of the Rev. L. L. Langstroth, The patent on this frame expired years ago. The size of the hive to use for the best results will depend largely upon the location. A Langstroth frame will if filled full of worker brood comb contain at least 6,000 worker brood cells ; allowing eight of these frames to each hive, we have, if all the cells were filled with brood, what would produce 48,000 bees when hatched. Beekeepers in some locations prefer nine and some ten frames in a hive.

If bees are to be wintered out doors one will need a double walled hive, the space between the brood box and outside to be packed with wheat chaff, short cut hay or straw, at least three inches thick. Too much drone comb should not be allowed in the hive ; if too much of it is allowed we will raise a large force of honey consumers instead of a force of honey gatherers. The queen is the most important bee in the colony—she lays all the eggs. The experienced beekeeper knows full well the importance of having each colony supplied with a prolific queen, and the progeny of the queen, the workers, should be hardy, long lived bees, and possess good honey gathering qualities.

Swarming is the natural instinct of bees. It is one thing that the veteran bee-keeper would control if he could without lessening the amount of honey produced by the bees. Some remove the queens before the bees swarm and cut out all queen cells built by the bees twice and after 16 days requeen the colony. Some consider this method better than hiring help to care for out apiaries. Some have entrance guards made of perforated metal, also queen and drone traps to prevent the queen leaving the hive with the swarms; in such case the workers finding the queen is not with them will return to the hive to repeat the operation the next day. The apiarist visits the outyard once each week and upon examination if he finds the colony

has swarmed or is nearly ready to swarm, he makes such changes as are necessary, and leaves the bees to care for themselves until his visit one week hence. The white honey flow in Vermont from which we get our supply honey, usually commences about June 10th to 15th. The best condition for a colony to be in at the commencement of the honey flow is to have the hive just crowded with workers, bees combs full of sealed and unsealed brood and the colony making no preparaion to swarm. Honey should be removed from the hives as soon as thoroughly sealed and placed in a warm well ventilated room away from all dust or insects. Honey stored in a dry warm room, will improve in quality if the temperature be kept warm and even for a number of weeks. The worker bees raised in August and September are the ones that live through the winter and care for the colony until young bees are raised in the spring. Every colony should have a good laying queen in the hive August 1st. All colonies should be examined in September and weak colonies united and all should have sufficient stores to winter upon ; 25 pounds of honey may do, but 30 pounds might be better some seasons. If bees are wintered in the cellar the temperature should be kept as even as possible in a dry cellar 40° to 45°. If a person cannot control the temperature and ventilation of his cellar, outdoor wintering would be preferable.

The site selected for the location of the apiary should be where no surface water would collect during heavy storms. The ground should not be uneven but have a gentle slope. In Vermont a southeastern exposure is preferable, and protection from cold spring winds is desirable. This may be obtained by wind breaks and probably a hedge of evergreen is as good as any and as cheaply provided.

THE GRASS CROP.

By DANA H. MORSE, Hillside Farm, Randolph, Vt.

Statistics reveal the fact that the average annual yield of the hay crop of Vermont from 1893 to 1897 inclusive was about 1,205,953 tons. It is also shown that during this same period of time the average price of hay per ton was $10.47 making the yearly crop worth the sum of $12,626,327, while the combined value of the wheat, rye, barley, buckwheat, corn and potato crops annually amounted to about $3,000,000. Hence grass may yet be regarded as *king* among all other crops of the earth, as well as the foundation of all agriculture.

Further explanation of these statistics show that the yield per acre of hay in Vermont was 1 3-10 ton, while some states scored as high as 3½ tons per acre, thus demonstrating the capacity of the soil to produce hay when in proper condition. Hence while much has been said and written upon the importance of raising a heavier yield of hay per acre, a thing of necessity when applied to Vermont, dependent as she is upon six months of dry feed for her stock, it may be pardonable, in view of this light average harvest per acre, to once again call the attention of the farmers to this subject, with the hope of stimulating them to renewed action along the line of raising more and a better quality of hay.

Dean Swift once said that "he who makes two blades of grass grow where only one grew before is a great public benefactor." And yet, of all sorts of vegetation, the grasses seem to be the most neglected; neither the farmer nor the grazer seem to distinguish the annual from the perennial, the hardy from the tender, the profitable from the unprofitable, nor the succulent and nutritive from the dry and juiceless. The study of grasses alone would be of great consequence to a northerly grass growing and grazing state.

To discuss hay or grass culture in detail would require more talent if not more time than is at my command, covering as it does the field from the tiny seed to the hay mow. But let me here say that in speaking upon this important topic, I do not expect to advance ideas altogether new or unheard of or prescribe methods, or lay out roads leading directly to the city of

wealth ; but shall be entirely content, in the event that any farmer may perchance glean a single idea that will lighten the burden of farm work, and make the margin of profit a little larger, and the farmer's home the brightest and happiest place on earth.

PREPARATION OF THE SOIL

Deep and shallow plowing have their supporters, but in my judgement plowing to the depth of four to six inches is as profitable and as well adapted to Vermont farms and crops as any other. Whatever may be the depth desired do not fail to plow well. Autumn has been found to be the best time to plow, 1st because it facilitates the work of the spring, 2nd for the reason that soils thus exposed to the frosts of winter harrow up mellower, pulverize easier, are more free of weed growth and yield better crops.

WHEN AND HOW MUCH FERTILIZER SHALL BE APPLIED.

When? As soon as the land is well plowed and so continue until spring—spreading the green, fresh-made stable manure, well preserved, broadcast upon the flatly turned furrow. The plowing under of heavy crops of green manure is no longer considered the best and most profitable method of farming. Turning large amounts of succulent green forage, proves injurious by causing the soil to burn, or sour, through the formation of organic acids. Moreover, there is much needless waste of valuable forage, which should be used to better advantage by feeding to animals. "*The feeding value of any forage crop is greater than its fertilizing value.*"

What quantites? Like all other matters, circumstnces must be considered, strong, deep, calcareous soils, with a clay subsoil should be manured heavily. Thirty to forty two horse loads to the acre are most profitable because of saving the cost of reseeding less often.

Land properly cultivated after being thus fertilized will produc from four to six tons of hay annually for a period of four to six years. No small grains should be used, especially if allowed to ripen its seed, in seeding such rich lands to grass. The loss of both crops is quite sure to follow. A heavy crop of corn, provided it has had thorough cultivation can be grown upon such lands very cheaply and profitably. Prepare the ground in the best manner possible with the spring tooth harrow, or some harrow that lifts the soil. Then apply the smoothing harrow, then if necessary use the roller for crushing dry or wet lumps ; follow again with the lifting harrow, rake it over once more

with the fine tooth, and plant your corn, using fine harrow again, soon after planting, followed by the weeder and cultivator if the land is inclined to harden, and so on until the corn is sufficiently high to protect the grass plant, then seed to the variety of grasses desired. Seeding in autumn, to grass alone, such lands as are subject to the overflow of a stream or river, or moist lands producing undesirable grasses is a royal scheme. Less quantities of fertilizer are required on such soils for the reason that weeds and wild grass are quite likely to come in after two or three years, and plowing again becomes both necessary and profitable. Autumn seeding of all lands that are well prepared is sure to yield good returns of all the desirable grasses except red clover which is *king* of the meadow. Once more *do not forget to harrow throughly.* It is the cheapest, the most effectual, cultivation known to man. It is purely economy for the reason that it disturbs the capillary evaporation of the moisture of the soil by the breaking and smashing of the flues through which the moisture would otherwise pass off into the atmosphere, thereby robbing the crop of the element which is indispensible to planth growth. Many careful and costly experiments have proved too, that even poor soil continually and throughly cultivated will produce a larger crop than rich soils poorly tilled and half cultivated. Hence when both carefully conducted experiments and common practice develope the same results, is it the part of wisdom or economy to pass the lesson unheeded?

HOW MUCH AND WHAT KINDS OF SEED TO SOW.

That depends on the quality of seed, the condition of the land, whether evenly distributed and in some cases the nature of the soil as regards moist or dry. In my opinion, it would be better in most cases, if farmers used less seed to the acre, and took greater pains to get the land in better condition. I think of no better formula in the use of seeds for rich upland soils than the following. Use seeds that are fully grown, well harvested and cured, well cleaned and true to name. Ten lbs. of red northern clover seed, three or four quarts of timothy, and four lbs. of alsike clover seed to the acre. Low lands and moist ground about six lbs. of red top, three quarts of timothy, and three or four lbs of Alsike clover to the acre, the latter sowed in early spring. Clover sowed later than the last of June or first of July is quite likely to winter kill.

CUTTING AND CURING HAY.

The day has come and gone for the use of the hand scythe and sickle. Mowing machines, spring seat horse rakes, ditto

hay tedders, hay loaders, horse pitch forks with pulleys attached which with a little planning by the farmer elevate the hay in almost a load at a time to the top of hay loft. One thing, however, is important to keep in mind i. e. in regard to how *much* of this paraphernalia is worthy of attention or can be profitably used by the farmer. Judgement and common sense are necessary elements to use in deciding in reference to these matters and often times mark the difference between success and failure in farm management.

Not too much can be said, however, in praise of the coming and use of farm machinery, not only as a labor saver, but also for the stimulus it has given farmers to clean and smooth their meadows, and even road sides, from rocks, loose stones and a useless and ugly growth of trees and bushes.

The weather b aureau too has come along to be of great service to the hay makers. While it cannot warn us of every shower that may come suddenly around the mountains, we can learn with a degree of accuracy the approach of storms of any continuation or length. No grass, particularly heavy grass, should be cut while the dew is on or when wet. Grass cut late in the afternoon so it does not wilt or dry by the heat of the sun, no harm will come to it if a heavy dew falls. It is a poor practice to cut grass in the middle of the day and leave it partially cured exposed to the dew or rain. The ideal hay is that which is cut and cured in a dry sunless day, with no dew, and with the least possible *handling*. A burning sun renders the hay brittle, and the most valuable part of it will be lost in handling. And while it is not our desire to injure the interests of any manufacture, right here we cannot fail to warn farmers to use the hay tedder with *care* and judgement.

Clover should be put in the cock as soon as wilted, not *rolled* up but pitched together in small cocks, when free of dew and warm. Carefully open them into two or three piles once or more, and when the water is all out and stalks fairly cured, put it into the mow. The closer it is packed and the tighter the barn, the better will be the hay or the clover.

The Hon L. M. Bonham of Oxford, Ohio gives us a formular for securing clover hay that strikes me with much favor. He says—"I put my clover hay in the mow the same day it is cut." (Speaking of mow he describes a tight mow)," The hay is far better and the labor and risk of making far less. I select a bright day and start the mowers as soon as the dew is off. Turn clover before dinner. Rake at one o'clock, put the hay in mow at once, while warm and free from external moisture. The clover hay thus made goes into the mow with every leaf on it, keeps bright and sweet and comes out fragrant clover, with all the heads and leaves of good color." Secure *all* of the hay

cured but not dried to death. Keep your hay mows level and trodden compactly as each load goes to the bay. Fill each hay receptacle as rapidly and as quickly as possible ; close your windows and barn doors every night, and let them be open as short a time as may be during any part of the day and your herd will make their lowest bow at the aproach of feed time, your income will be greater, your family happier and contentment with your calling will be your abiding guest.

The importance of curing hay, the effect upon its digestibility by drying cannot be to well understood, or too impressively stated. Upon this point Prof. H. P. Armsby most truly says : "The digestibility of the organic constitutents of a fodder is in *no way* altered by simply drying in the air, provided it is executed without loss of parts of the plants. The *ordinary* method of making hay involves a *great loss* of leaves, and the product suffers not only in *quality*, but in its *digestibility* as well."

QUALITY AND TIME OF CUTTING.

Quality of hay may be effected very considerable by the condition and fertility of the soil, as established by abundance of experimental evidence. Fertile soils add nutrition to all forage crops.

Practice, scientific experimental work, common sense, and nature herself all combine their testimony in favor of the superiority of early cut hay, other things being equal, to late cut, in respect to its composition and digestibility. The scientist on every hand tells us that young grasses while rapidly growing contain more protein, (the quality most valuable and rare), and less fibre than more mature ones, consequently early cut hay must be of better quality than when cut late. It is more digestible.

We are advisedly admonished that grass in ripening transmits a large part of its protein and starch from the leaves and stem to the seeds, which are seldom, if ever masticated or digested.

Generally they are lost in curing. In the language of the scientist, "The hay made from fully ripe grass is essentially straw." Since science confirms what practice has found to be true relative to the value of early and late cut hay, let no farmer in Vermont rest content until his hay crop is improved in quality, and doubled in quantity. His first crop secured in June, the second in August or September filling his barn to overflowing with sweet succulent grass, nutritious, palatable, and digestible, remembering that grass, is only another name for beef, mutton, butter cheese, food and raiment.

"Then learn to toil and gaily sing
All flesh is grass, and grass is king."

FARM DRAINAGE.

By Rollin W. Whitney, of Springfield, Vt.

In speaking to you upon farm drainage, I do not claim to present any new discoveries, for land drainage in some form is as old as civilization. Roman writers upon agriculture speak of draining and the remains of ancient drains have been found in Italy and England which are believed to be of Roman origin. The Egyptians were past masters in the art of draining and irrigation, when Pharaohs daughter found Moses in the rushes.

But notwithstanding the benefits which it is well known we may derive from draining it is so little practiced in New England that one might have to take quite a journey before he would find an object lesson in draining.

Whoever can control the supply of water in the soil in effect changes the climate, makes the season longer and reduces the dangers of crop failure to a minimum. Thoroughly drained land can be worked earlier in spring and more quickly after a rain than the ordinary heavy soils that do not require draining. Drained lands will also withstand drouth better and there is practically no danger of over-draining, that is of making the land too dry, in fact it will make the soil more porous and cause it to retain a sufficient amount of water for a longer time when it is very dry.

It has been found that at the depth of seven inches soil in which the stagnant water has been removed by underdrains is from six to ten degrees warmer in summer than similar soil which has not been drained. This makes a change of climate equal to an elevation of from two to three thousand feet or we may say adds two or three weeks to the length of the season, which is of great value in Vermont where the farmer, each year, has a race with the climate in his efforts to get the planted crops in early enough so that they will ripen before the first frosts in the fall. Grass roots under favorable conditions often penetrate the soil to the depth of two feet, but if stagnant water rises to within a few inches of the surface the rootlets will all be stopped there as though met by a solid rock. No valuable forage plant will grow where the soil, or the subsoil, contains

stagnant water,but in such places only a coarse, poor quality of grasses or aquatic plants are seen, which lessen in value as the water rises nearer the surface.

Probably the first attempts at draining were shallow trenches to convey the surface water. This was a cheap but not very effectual method and there is a constant waste of fertility which is carried off after every shower or by melting snow in the spring. But with the use of farm machinery came a demand for covered or under-drains as they are usually called, which are to be understood when draining is mentioned. The material for under-drains is usually stone or tile, but brush, straw and other substances, such as weeds and tan bark have been used, but drains made of these materials, which if near at hand may make a cheap job, must of course be short lived and then the work must be done over again. Under-draining, as applied to modern agriculture, was first extensively used in England during the last half of the eighteenth century. Stone was used in many ways and tile was first used in farm draining. Many systems and theories were put forth, none of which were practical for all conditions of soil. It was claimed that all land, both wet and dry, would be benefited by drains. But these theories are too finely drawn for practical Vermont farmers and the only lands in Vermont that really needs draining are the low-lying meadows, swamps and hillsides where the water from above works through the soil until clay or hardpan is reached, which brings it again to the surface or nearly so; also where there are springs which rise to the surface and discharge enough water to make a bog of more or less land which lies below. These last are perhaps the easiest of all to drain, for if the spring can be tapped the whole source of trouble can be removed at once.

When I was a lad, upon a farm which joined my father's an English farm hand was set to dig an open ditch to take the water from a spring to a small stream a few rods distant. He explained to his employer that he had seen in England a stone water course laid in the bottom of ditches and then the dirt replaced, leaving the field smooth and even. He was told to finish the job in his own way. That underdrain which was the first of any extent in that section, is I believe, doing good work at the present time. The spring which it was sought to remove, in finding its way to the brook kept constantly wet one or two acres of fine alluvial land which never was or could be plowed ; this one underdrain rendered the whole dry enough to cultivate and it has produced fine crops of first quality hay, and grain at times, but as it lies very low and is liable to flow it is usually kept in grass.

This farm and two adjoining ones further down the stream, contained broad and very wet meadows. The owners of these farms at once saw what great improvement could be made upon their meadows and commenced the work of draining them. In a few years, without any considerable outlay, these three farms from being among the poorest in that section beacme rated with the best. This work was mostly done by the regular farm forces in the less busy season of the year, and the stone which was found upon the higher parts of the meadow and pasture was used to make the drains, except a few small drains upon one of them, which I now own. Two inch sole tile was used.

Perhaps enough has been said of the advantages of underdraining. I think all will concede that great improvements can be made upon many of our farms in that way. But then comes the Yankee question, "Will it pay?" and I can only give the old lady's answer, "Well, that depends."

At the price of farms in Vermont today I would not buy a low, wet farm thinking to drain it at a less cost than I could buy land that had a natural drainage. But on the other hand, where one is located and proposes to spend his life, can he afford to give up a low meadow to a crop of inferior hay when with proper drainage it may be made the most productive on the farm. Such land has been accumulating fertility for ages, which when the water is removed, at once becomes available. The first crops from underdrained land are usually fine, although some swamp and clay land need exposure to frost and sun before the best results are obtained.

Or if a spring breaks out upon a hillside and causes more or less bog below, can one afford to go around this spot year after year with plow, harrow, cultivator and mower in these days of machinery when more than ever before time is money? I remember seeing a neighbor clearing out and draining a wet rocky gulch in the middle of an otherwise smooth, fine field. Some one remarked that it would cost one hundred dollars to do the job and that the land would be worth about fifty dollars when it was done. "Perhaps so," said the owner. "I will give you the land if you will take it off out of my way, but I won't have it here in the middle of this field any longer." That was many years ago, and I often think of it when I go by that farm, and I think now that it was a better investment than a western mortgage would have been. Mr. Spaulding, the owner of one of the three farms mentioned, who kept a strict account, told me that the extra value of the first three crops usually paid the whole cost of draining. Not all the draining upon these farms was done upon low lying land, but the upland

when needed was underdrained and some of the pastures were reclaimed and made fine plow land.

To the man with capital who has an extensive job of draining to do, the only advice I have to give is to procure a practical engineer, have the levels taken, and the entire system laid out. To begin with, buy tile by the carload, for where the labor is taken into account the tile will be as cheap in the end and will be found less likely to clog and need repairs. Then put on a force of laborers and complete the job as soon as possible aud enjoy the satisfaction of having caused two good blades of grass to grow where but one poor one grew before.

But most of the farmers of Vermont are at work with a small capital, and to those like myself who wish to put in permaneut improvements with a small cash outlay, I am willing to give some of my experience which may be of benefit to them. Farm draining, if thoroughly done, is a permanent improvement which no rise or fall in stocks will cause to pass a dividend, and no thief cau carry away.

Before I had ever read a book upon farm drainage I had served an extended apprenticeship with a pick and spade. But I would recommend any oue before beginning to drain to obtain a work upon drainage and familiarize himself with the subject. Most of the works upon this matter are from English sources or compiled from them by some cute Yankee. The climate of England is so different from our own that allowance must be made for that, England has what is called a wet climate and New England a dry one, but more rain falls here than there. These rains are of frequent occurance but small in quantity ; no such heavy downpuros are known as frequently are seen here. Therefore it is wise to use larger tiles than are recommended in the books. From one to three inches was formerly recommended by the English authorities although I think it is now conseded that one inch is too small for any drain, as not enough water can flow through there to wash away the sediment that will collect ; a two inch tile or a four inch stone drain is as small as I would ever use on branch ditches and for main lines considerably larger than these. A stone drain owing to the rough surface which it presents should be made larger than a pipe or tile to carry off the same amount of water. In deciding the size of our drains we should remember that pipes will convey water acording to the squares of their diameters, a two inch tile will carry four times as much water as one but one inch in diameter and one four inches in diameter four times as much as one only two inches. In practice I think the proportion will be ever greater than this as the friction will be less in the larger pipe. Most of my drains are of stone which have worked fairly well but tile are more satisfactory because they are less likely to clog and in many cases

may be as cheaply made. They are however so little used in Vermont that I know of no place where they are manufactured at the present time within the state, and frequently the freight will cost more than the tile. If there was a demand they could be made at any brick yard about as cheaply as bricks.

Two things are absolutely essential in draining, viz.: a good outlet and a continuons fall from head to outlet, and it is better to have the fall as uniform as possible. With a great fall more water will pass off and the size of the drain can be reduced, but successful work can be done with a very slight fall, a few inches to the mile makes quite a rapid stream. If a continuous fall is not maintained the flow of water will be checked and sediment which is constantly working into all drains will soon become compact and stop the flow of water entirely.

The poetry of draining all comes in after the job is done, and of those who are afraid of mud on hands or boots or who have much "town business" or a steady job for all spare time at the corner grocery, I do not expect to make converts, but having shown the advantages of draining and that, in many cases at least, it will pay, I will briefly give some hints as to how the work is best performed.

In draining low land the main ditch should follow the greatest depression, if short cuts are made the water or portion of it will find the old channels, and you will not have a perfect drainage; branch ditches may be dug upon either side as often as seems necessary. I know of no set rule for distance. If the main lines are rightly located, additional branches can be added later if all the water is not reached at first. Branch ditches should not enter the main line at right angles and their bottom should be a few inches higher than the main ditch, so that all sand and soil that works in may pass off readily. As to the best depth, again I can give no rule that will fit all cases. There has been more controversy in regard to this than all other matters pertaining to under-draining. Other things being equal, the deeper the ditch the wider space will be drained. My own experience is that a moderately deep drain is less likely to choke than a shallow one. But the nature of the sub-soil and the amount of fall must determine that. The cost of digging two ditches three feet deep would not be as great as one of five feet deep, and a three feet ditch may be in some cases as efficacious as the deeper one. I should advocate a depth of three feet at least, when possible and more if it seemed to be required. In very few soils will there be any danger of placing the drain too deep, as the water will find it, and it becomes a question of cost and expediency. In opening the ditch always begin at the lower end, and where the land will hold a team use a plow to loosen the dirt

before using the spade. One man with a team and plow will loosen more soil than ten men with picks and if no pick is required a man will throw much more loose dirt out of a ditch than he can spade out. Too much stress can not be laid upon having a continuous fall, for on this depends the value of the drain. When there is flowing water in the ditch this is all the level needed, but if there is no water some method must be used to keep a true grade, for it will not do to trust to the eye where the surface is uneven, as is usually the case. An A level as it is called, is useful for this purpose and may be made by any one in a few minutes. Two pieces of common inch board with a cross piece may be nailed in the form of the letter A. Place the feet upon a level surface like a barn floor, attach a plumb line at the top and mark where it falls upon the cross bar then place a block just an inch thick under one foot and mark where the line crosses the bar, or raise the foot another inch and again make a mark upon the bar; continue in the same way if thought necessary. Then put the blocks under the other foot and mark in the same manner and you will have a level that will answer every purpose. A ten-foot span is a very convenient length and when placed in the bottom of a ditch the mark on the cross bar which the plumb line crosses will indicate the rise or fall in inches for ten feet. Whether I used tile or stone I would always place a board in the bottom of the ditch, the tile will make much closer joints in this way and there is no danger that they will be moved by settling unevenly. The joints of tile should be covered with something that will prevent the soil working through before it is thoroughly settled, an inverted sod, straw, or forest leaves, will answer for this. The first dirt should be carefully placed around the tiles and firmly pressed with the feet being careful not to move them or disturb the joints. Always begin at the head of the ditch to lay stone or tile and work toward the mouth. In making a stone drain the ditch will have to be considerably wider on the bottom than where tile is used which should be considered when deciding which to use. Stone drains can be made by any one who can construct a fence wall. Stones of suitable size are laid along the sides after a board has been laid down using small stones to make the joints as close as possible flat stones are laid upon them again using small stones to close all openings if flat stones are not at hand boulders of suitable size to reach across the ditch can be used if the drain be deep enough so that they will not be so near the surface as to be disturbed by the plow or reached by frost. After the stone work is done place brush, straw, hemlock boughs, or some similar substance over them and put on enough dirt to cover them as with tile and finish filling with a scraper or plow.

In draining hillsides the ditches should be made to follow the greatest incline, and spaced so as to do a thorough job. If made diagonally along the hill "water will find its level" and more or less leakage will occur which will find its way to the surface below the drain. Sometimes an open ditch to catch the surface water may be required along the upper side of a field which has higher land above, which is the only open drain I would ever use. At the bottom of the field if there is no natural outlet for drains a main drain may be laid, into which all the others may discharge and the water be carried to some bluff or stream. Some have advocated dumping stones into the bottom of a ditch and allowing the water to work its way through them. When there is a small amount of water and considerable fall this may do fairly well, but such drains are apt to be short lived and unsatisfactory. A drain filled with very coarse gravel in the bottom with fine gravel or sand on top will be more durable and less likely to clog than one made of loose stone. Do not expect to do draining without hard work by some one, and when done they require care. "Eternal Vigilance" is required in most of the affairs in life. The outlets must be kept clear, and occasionally when the best of care is used a drain will clog. The sooner it is dug up and cleared out after it is discovered the less work it will be to remedy it. It may be the work of a few minutes at first, which if neglected will require days to make right again

I have raised more than one hundred and fifty baskets of corn per acre on land from which before it was drained the hay had to be carried off by hand, as parts of it were so soft that a team could not be driven over it and some of it was so wet that it would raise nothing but cat tail flags.

HOME MIXING OF FERTILIZERS.

By Ernest S. Brigham, at North Tunbridge, March 1st.

The question of fertilization is one of particular interest at the present time. We have heard our grandfathers tell of the wonderful crops of potatoes grown upon land which knew not the stimulus of manure, of the crops of corn harvested from seed planted among the stumps of the newly cleared fields, and of the grass which grew almost shoulder high in ante-mower days. But those times belong to the past here in New England and now if the farmer wishes to crowd the "old barn eaves" with the fruits of the harvest and compete successfully with the newer lands of the west, he finds it necessary to go to the mine, the mill and the factory for materials with which to reinforce the plant food in his soil.

How to purchase and apply these materials most cheaply is a question of great importance. The most popular way at the present time is the purchase of the ready mixed fertilizers offered for sale by the manufacturers, and we find upon referring to the bulletin 65 of our Vermont Experiment Station that no less than 126 brands of these mixtures were offered for sale in the State last year—variety enough it would seem to satisfy the taste of the most fastidious plant.

It is interesting to study the analyses of the different brands given in this bulletin, and they certainly should be carefully studied by every buyer of fertilizer. Take for instance a fertilizer which was sold in our section of the State last year for $26 per ton, and we find that it was valued at $16.49 per ton by the station valuation, which is the valuation based upon "retail cash prices of the various fertilizing ingredients in the large markets, unmixed but ready for use." That leaves in the case of this fertilizer the sum of $9.51 which went to pay the cost of mixing, bagging, freight, agent's fees, etc. Thus we see the purchaser of this fertilizer, which is one of average quality, received 64 cents worth of plant food to the dollar invested, the remaining 36 cents going to pay the above named expenses. We also find in the same bulletin the statement that "two dollars out of every five spent for fertilizers went to pay the cost of manufacture and sale." In these days of close prices, the

farmer may well ask himself, "can I afford to pay so large a sum as this for the manufacture and sale of my fertilizer," and I will venture to say that he cannot, if he can in any way reduce this expense.

How may it be done? Some farmers in this State and a large number in States further south have adopted "home mixing" as the means of solving the problem.

"Home mixing" consists simply in buying, usually for cash, the crude fertilizing materials, such as sodium nitrate, dried blood, tankage, bone-black, acid phosphate, etc., unmixed, and mixing them together at the farm. My experience in this business dates back to 1897. A careful study of the matter convinced me that a saving could be effected, and so, having won my father over to the scheme, I decided to give it a trial. Having found out that the raw materials could be purchased from any of the fertilizer companies as easily as "sugar and spices" at a grocery store, I sent a list of some of the best known raw materials to seven different companies, asking them to give me prices on the same. Before long, beautifully colored catalogues began to arrive, setting forth the merits, by testimonials and illustrations, of this and that particular brand; and one company was so kind as to send its agent around to tell me that I was on the wrong track, and that I had better give up the undertaking. But at last one company sent the desired quotations.

Now came the problem of what materials to use and how much of each, and this is indeed a puzzling problem to the beginner. A careful study, however, of bulletin 47 of our Vermont station and other bulletins which I obtained for the asking from the Rhode Island and New Jersey Experiment stations, reinforced by a little chemistry soon cleared up the mystery, and with a few changes I used one of the formulas given in the bulletins, which was as follows:

200	lbs.	sodium nitrate.
400	"	tankage.
1,000	"	dissolved boneblack.
400	"	muriate of potash.

I made arrangements with the local agent for the company from which I received the quotations, to have the chemicals come in the same car with his mixed goods, thereby reducing the freight to car-load rates, and saving about $1.00 per ton.

When the goods arrived, the next thing was the mixing, and this may be called the laborious part of the business. With one man for a helper I undertook the task one rainy morning. Since this was a new business to us, we thought it best to make haste slowly, so we began by mixing about 500 pounds at a time. After weighing out the different materials in the right proportions,

we spread them down on a tight floor in layers, the most bulky at the bottom. Then having shoveled them over three or four times, much as one would in mixing grain, we ran the mixture through a course sand sieve to take out any lumps that might bother a planter. By mixing so small a quantity at a time, we soon found that a good deal of time was wasted in weighing out the chemicals, and we also found the sodium nitrate so lumpy that it had to be pounded, thus causing much extra trouble. Consequently we had to work very hard all the forenoon in order to mix half a ton. My helper concluded by this time that he would rather saw wood, and, before night, said that he wouldn't mix another ton anyway. But after that, by mixing a ton at a time we were able to get along much faster, and last year, having had the sodium nitrate freshly ground before leaving the factory, two of us were able to mix and bag a ton in three hours.

Now we come to the results. I sent a sample of the mixture and of each chemical to the experiment station for analysis. With the aid of the formula it was very easy to compute from the analysis of the chemicals what the analysis of the mixture should be if the mixing were properly done. The result showed the mixing to be very perfect. The mixture was valued at $28.89 per ton at the station valuation. The cost of the ingredients for a ton delivered at our R. R. station was $29.60, thus giving 97.6 cents worth of plant food to the dollar invested. We used beside this mixture a ton of factory mixed goods which ranks well among the medium grade brands. Its cost was $28.00 and its station valuation $18.79 thus giving 67.1 cents worth of plant food to the dollar. Then a dollar invested in the home mixed fertilizer purchased 30½ cents more plant food than a dollar invested in the manufacturer's mixture, and if figures don't lie, a saving of $8.50 per ton was effected by home mixing.

Last year, upon recommendation of Prof. Hills we used a formula consisting of:

200 lbs. sodium nitrate
400 " cotton seed meal
1100 " acid phosphate
300 " muriate of potash.

This fertilizer costs $24.32 per ton delivered at our R. R. station. I did not have it analyzed, so cannot give the station valuation, but the field results were all that could be desired, and it is safe to say that from 88 to 99 cents worth of plant food was received to the dollar invested.

From my experience I believe that home mixing pays. A high grade fertilizer may be obtained at a moderate price, the formula may be changed to suit particular conditions, and an inducement is offered for the study of the principles of fertilization. Home mixing can not be done by chance; its details must be care-

fully studied, and, indeed, I believe the day has gone by, if it ever did exist, when the farmer can afford to carry on his business by chance. Home mixing is shrouded in no mystery which a little intelligent study will not clear up, and if any of you try it, I hope you will find as much pleasure and profit in the undertaking as I have. In closing, let me advise the beginner to get all the fertilizer literature he can, to study it carefully and intelligently, and not to be afraid to ask our Experiment Station for advice.

COMMERCIAL ORCHARDING IN VERMONT.

By T. L. KINNEY, at a meeting of the Board of Agriculture in Hinesburgh.

Growing of certain varieties of fruit in Vermont for commercial purposes is getting to be of interest to many of the farmers of our state. It is but very recently that we thought we could raise fruit to any advantage except in a few especially adapted locations, but now we find that we have only to ascertain the variety adapted to the location and go ahead. Great credit is due to Dr. Hodkish and others who have given much time and patient work to studying up new and profitable varieties for the various parts of the state, and to the experiment station and Honorable Board of Agriculture for extending and distributing this knowledge among the farmers in many towns where it was thought that even apples of good quality could not be grown.

It has been thought that Western competition would put an end to Vermont commercial orcharding, but the apple is very largely placed on the market in its native grown condition, and not like butter and cheese, a manufactured article, and it establishes its standing on the markets by the location and circumstances under which it is grown.

For several years Vermont apples have stood on the New York markets at an advanced price above apples from any other section of the country, and this advance price has been constantly growing from year to year, and with a thorough and intelligent study of the best methods of production and the best methods and manner of marketing, we will be able to hold our position and add new markets to those which we now have.

The quantity of apples now grown in the state is quite important, there being grown in Grand Isle county alone in 1896, 40,000 barrels of merchantable apples. This fruit was grown from about 35,000 trees and there is yet to be heard from more than 17,000 trees that are not yet of bearing age.

The south island of this county in 1896, produced 22,000 barrels for which it received $20,000, and in 1898 it produced 10,000 barrels for which it received more than $30,000, and now there are many towns in the state that have large commercial apple orchards.

The number of trees for a farmer to set for a commercial orchard depends entirely on his circumstances or surroundings. A small orchard well cared for will be remunerative, while a larger orchard can be worked with about the same machinery and convenience of a smaller one.

Cultivation in an orchard is of the same importance as in any hoed crop and should be worked under the same general principles. Orchards that are so rough and uneven that they can't be profitably cultivated, should be treated by mulching and pasturing in as judicious a manner as the intelligence of the farmer can prescribe. Pruning commences when the orchard is set and continues year by year until the very last which is generally done with an axe, and the last pruning is never done by the man who sets the orchard, as the orchard will out-live the lives perhaps of several men.

Thus we should bear in mind that when we set a commercial orchard it is not simply a matter of to-day, but that it should be more valuable in the last half century of its existance than the first.

The fertility of the orchard is a very important item, for the product of the orchard, like the dairy, depends very largely upon what and how we feed it. The experiment station and horticultural professors should be appealed to often on this line.

Spraying has come to be one of the necessities of successful orcharding and should be very thoroughly understood and rigidly practiced as much time and money has been spent in unsuccessful work along this line. The whole matter is very simple when well understood. Paris green for insects and worms that eat the bud or leaf, kerosene emulsion for aphies and insects that suck the juice, and Bordeaux mixture for fungus growths, and a good spraying apparatus and we have the whole matter well in hand.

Harvesting and marketing are matters that seem of but slight importance, but often count up terribly in the cost of production, and if looked after with neatness, pride and care will count up wonderfully on the credit side when the fruit gets to market. It is a well established fact that no good fruit man can go to market with a clean conscience and a dirty package. Every orchardist should become known to and well acquainted with some good, up-to-date fruit house, and stick to them until his brand of fruit is known and sought after by the customers of this especial house, and not be changing it around from one house to another and never known by any.

THE VERMONT EXPERIMENT STATION AND SOME OF ITS WORK.

By CASSIUS PECK, Farm Superintendent, at a meeting of the Board of Agriculture in Wolcott.

The Vermont Experiment Station was established by an act of the Vermont Legislature passed in 1886, whereby $3,500 annually was appropriated to carry on the work. The duties of the Experiment Station included the analysis of soils, feeds, milk, butter, water, fertilizers and other substances provided in the judgment of the Station staff such analysis would promote the public welfare. The provisions of this act attached the Experiment Station to the University of Vermont and State Agricultural College and placed it under its supervision.

The clause requiring the Station to carry on experimental work with the various new fodder crops and feeding stuffs, necessitated the purchase of a farm. This farm was located in South Burlington, three and one-half miles from the college grounds. Upon trial it was found to be too far removed to be of use as an experiment farm and in 1891, land was purchased adjoining the college grounds and suitable buildings erected consisting of farm house, two barns, creamery and green house. The barns are 106 by 46 feet and 60 by 26 feet, while the three ells are 40 by 34, 40 by 36 feet and 30 by 20 feet. The barns are used for storing hay, straw, etc., and have three silos. The ells are used for carriage house, horse barn and storage for farm machinery. The green house where experiments are carried on under the heads of the several departments is 80 by 24 feet. The creamery building where the experimental work with the milk of the Station herd is carried on and the balance prepared for market is 75 by 36 feet in dimensions. The dairy school which has become very popular is conducted in this building. Annual sessions have been held for eight years, beginning the second week in January aud continuing for one month. Eighty applications were received for the session of 1898, but the accommodations are limited to fifty students. Twelve separators were in use, nine hundred pounds of milk were separated daily and results

observed. Four instructors were employed under the supervision of Prof. Hills who outlines the work. Lectures were given by members of the Board of Agriculture and other prominent speakers. The expense of the dairy school is borne by the College.

A bee house was built in 1894, and experiments are conducted under the direction of the Beekeepers' Association and results reported at its annual meeting. There are now thirty-two colonies of bees in the station apiary.

The National Congress passed an act in 1887, known as the "Hatch Act," providing that $5,000 be paid annually to each of the States and Territories to carry on much the same line of work already begun in Vermont under the act of the State Legislature of 1886; hence in 1888 the section of the act of 1886, granting the appropriation of $3,500 annually, was repealed, leaving the balance of the act in force. Since the passage of the Hatch Act the State has not contributed to the support of the experiment station.

The sampling and testing of commercial fertilizers was placed in charge of the Director of the experiment station by an act passed in 1888. The expenses thus incurred, amounting to several hundreds of dollars annually, were met by the station from the proceeds of farm sales, until 1894, when the act was amended by providing that the expense should be paid from funds received from licenses granted.

One thousand dollars annually was appropriated at the session of 1898 to the experiment station for printing and distributing reports and bulletins. This session also passed "An Act to Regulate the Sale of Concentrated Commercial Feeding Stuffs," also "An Act for the Protection of Dairymen, relating to testing of milk and cream." The director of the station is made the executive officer in both acts.

The experiment farm contains 130 acres, eighty acres under tillage and fifty in pasture. The pasture and meadow lying at the east have a light soil, while the balance is heavy loam with a strong mixture of clay. The apple orchard, which was top grafted two years ago, is looking fairly well, and there is a good supply of the small fruits.

The past season sixteen acres of corn produced 100 tons of ensilage, and eight acres of oats harvested sixty bushels to the acre. The oats were sowed in drills, three bushels to the acre, grass seed sown broadcast, fifteen pounds alsike clover and ten pounds of timothy to the acre. Corn was raised on this land the previous year, it being fertilized with barn manure. From fifteen to twenty hogs are kept in the cellar and the manure is drawn out each week and spread broadcast. Cut straw and saw-dust are used for bedding.

Haying began June 6, about 190 tons being harvested. The hay cut from one piece of new stocking of ten acres, weighed thirty-six and one-half tons; the rowen crop was fed green and was not weighed. Sugar beets gave a high yield as compared with other varieties, but proved very acceptable to the stock. An acre of artichokes were raised and fed, the results of the trial are not yet ready for report. Foul meadow grass was sowed on low, wet, heavy soil with gratifying success. Delaware and White Star potatoes were planted the middle of May. We used the Aspinwall planter which drops potatoes and phosphate, covers and marks next row and does good work. The potatoes were sprayed with Bordeaux mixture after adding one-half pound of Paris green to forty gallons of the mixture. The rows sprayed three times yielded 238 bushels to the acre, those sprayed twice 185 bushels, while those left not sprayed bore but 111 bushels to the acre. They were sprayed the first time with the fungicide on, July 22, Paris green having been used twice before. The tops of rows which were not sprayed were dead by the first of August, while the rows sprayed three times were green until the frost of October 10th. The Bordeaux mixture is composed of four pounds of lime and six pounds of blue vitrol to 40 gallons of water. Other commercial mixtures were tried but all proved less satisfactory than Bordeaux.

The stock consists of fifty-one cows and heifers in milk, three dry cows, twelve heifers under two years old, one bull, Mint 10th, purchased from Hood's farm, one yoke of oxen and six horses. The cows are fed from sixteen to twenty pounds of hay, twenty to twenty-four pounds ensilage and seven to eight pounds of grain daily. The feed of each cow is weighed daily, oats weighed and deducted, the milk weighed and sampled for testing. For instance, the cow Flora on March 8th was fed sixteen pounds of hay, twenty-four pounds of ensilage and seven pounds of mixed feed No. 2, and left uneaten one pound each of hay and silage. She gave 44.7 pounds of milk, which tested 4.28 per cent. fat. A similar record is kept of each cow throughout the year.

At present seven kinds of feeds are used in the feeding tests of the winter.

No. 1. 3 parts bran, 2 parts corn meal, 1½ parts cotton-seed meal, 1½ parts flax-seed meal.

No. 2. 3 parts bran, 1 part corn meal, 1½ parts cotton-seed meal, 1½ parts flax-seed meal.

No. 3. 3 parts bran, 1 part corn meal, 4 parts buckwheat middlings.

No. 4. 2 parts bran, 2 parts corn meal.

No. 5. 1 part bran, 2 parts corn meal.

No. 6. Oat feed.

No. 7. Buffalo gluten feed.

The experimental periods of feeding continue five weeks, when each cow is weighed and some other grain substituted with the same hay and ensilage ration. Three lots of three cows each are on an experimental feed of oats, the object being to ascertain if butter fat can be fed into the milk.

Lot No. 1. Fed 1¾ pounds of corn oil per day with grain ration.

Lot No. 2. Fed 1¾ pounds of cotton-seed oil per day with grain ration.

Lot No. 3. Fed 1¾ pounds of linseed oil, the same ration of hay and ensilage continued.

The results of these experiments will be published in the twelvth report which will be issued in the winter of 1899-1900.

Such persons as are interested in the work of the station are cordially welcomed to visit it and to view its work. Its publications, six to eight a year, are sent free on request.

THE BEST AND CHEAPEST METHOD OF STOCKING PRIVATE WATERS.

The recent legislature enacted a law, No. 101, Acts of 1898, amending the private posting law, Section 4626 of Chapter 189. Under the amendment, the latter is not effective in the posting of private waters "unless the owner or occupant shall stock and keep stocked at their individual expense the waters of said land with trout or other fish artificially hatched or reared." Chapter 189 also specifies that the Commissioners shall not stock from the State Hatchery, any privately posted waters. It therefore devolves upon those who would avail themselves of the private posting law to annually stock their waters at private expense. In order to do so, they must either purchase fish at great expense, a large part of which is transportation, or procure eggs and hatch the fish.

The scope of this article is to show how individuals may comply with the amended law and stock their waters at a minimum expense by procuring the eggs of trout, which can be bought at a low figure, and hatching them on their own premises.

THE FINANCIAL QUESTION.

Fry delivered in the months of April and May in small lots, cost at the rate of $2.00 per thousand at commercial hatcheries, most of which are located in Massachusetts and Rhode Island. The fish are either shipped by express in patent cans or sent in ordinary cans accompanied by a messenger.

10,000 fry @ $2.00 per thousand,	$20.00
Expressage, estimated,	5.00
Cost of Fry at nearest R. R. Station,	$25.00

If a messenger accompanies the fish, which is the customary method, add $2.00 per day for his services; add his car fare and subsistence enroute and the bill will be at least $12.00 more. The cost of fry will then amount to from $25.00 to $40.00 delivered at the railroad station.

Eggs can be bought for 50c. per thousand and expressage. Estimating the expressage at $1.50 and the total cost of 10,000 eggs is $6.50. In large lots, eggs sold as low as 25c. per thousand last season It may be possible to obtain the eggs of the United States Fish Commission, in which case the only

expense would be expressage. At the lowest estimate on the cost of 10,000 fry and the highest estimate on eggs, there is a balance of $18.50 in favor of the eggs. The eggs must now be hatched which means that you must equip yourself with a miniature hatchery and then give the eggs care and attention a short time daily for two or three months. Two advantages of purchasing eggs, aside from the financial question, are that the product can be planted at your leisure, a few at a time, and the fish will be fresh and strong.

The cost of fingerlings is so much greater than that of fry, being at least ten times as much, that I have not brought them into my comparison with fry and eggs, although the results obtained by planting them are most satisfactory.

Transferring Eggs from Packing Trays. *See p. 104.*

In this article, I shall only give the details for procuring and hatching trout eggs, receiving the eggs in the form of "eyed ova" and conducting the work of propagation until the fry have hatched and are ready to be fed or be planted. The subject of rearing to fingerlings belongs to another chapter, when the fish require more water, more critical care and at a season when farm work demands more attention.

WATER SUPPLY.

This is the most important question to be considered both as to quantity and quality. If a hatchery is to be constructed, the water supply is the first consideration and the location of the

hatchery is dependent upon it. As this article contemplates the necessity for only a small floor space to hatch enough fish to stock one stream or a portion of it, room for the hatchery may be found in the barn, barn cellar, cellar of house or some other available space protected from the inclemency of the weather. Assuming that there is floor space somewhere about your buildings, can you run your present water supply into it and have you sufficient flow of water to spare some of it for fish cultural purposes? A consideration of the following requisites will enable you to decide. First, the supply can be from a spring, a brook, a pond or a lake. Fish culturists differ as to which is preferable, but conditions vary in different localities and climates. In Vermont, very few brooks are free from sediment at all seasons. Springs, if tapped at their sources, are practically free from sediment and give an even temperature. Perhaps it would be well to make it the first condition that the water must be free from sediment. That is, it must not become roilly during the frequent thaws in winter, or the heavy rains of spring time. Second, it should be of an even temperature throughout the period of incubation. This last is not essential, but preferable. In our climate, the normal temperature of spring water at the source of springs is 46 to 48 degrees and does not vary from that amount summer or winter more than five degrees. If allowed to flow along the surface until it forms into a brook, the temperature will of course be reduced in winter and raised in summer, but will be comparatively even. Trout eggs can be hatched in any temperature of spring water, or in a temperature varing from 33 to 50 degrees Fahrenheit. I prefer a temperature of from 36 to 44 degrees during the period of incubation, rising to 60 or 65 degrees for the little fishes as warm weather approaches. Ordinarily, the water supply for a house and stable is suitable for this work if a sufficient volume of it can be spared to flow steadily, 24 hours a day, for every day the hatchery is in operation. A city water supply can usually be regarded as suitable. Trout cannot be hatched successfully unless the eggs have a constant flow of water. It cannot be diverted temporarily for creamery or domestic purposes without danger of weakening the eggs. The quantity of water depends upon the number of eggs to be hatched or the number of hatching troughs to be used. The minimum amount of water allowable for one trough whether to contain 10,000 eggs or double that number, should not be less than two gallons per minute. The simplest way of ascertaining whether there is a sufficient flow of water is to catch the flow in a pail of known measure and see how long it takes to fill the pail. If you have a spring of unknown volume, put in a temporary spout with earth packed around the intake end, long enough to conduct the water to a point where it can be caught and measured. Do not

attempt to run the smallest hatchery on less than two gallons of water per minute.

It may be best to construct a small building for a hatchery near the source of supply and save piping the water. For an isolated building spring water has several advantages; it is not liable to freeze either at the intake or in the hatchery; artificial heat for the hatchery is unnecessary except for personal comfort in working over the troughs. There is one disadvantage in using spring water; the fry may develop so rapidly that they will be ready for distribution before the waters to be stocked are free from freshets.

Brook water, a considerable distance from the springs which are its source, may give trouble by freezing at the intake or still more in the troughs, unless the hatchery is artifically heated.

Water from large lakes or ponds, if taken several feet below the surface, gives an even and favorable temperature for hatching eggs slowly. Do not take water from a bog or stagnant pond. Eggs and fry need air which is taken through the medium of clear, sparkling water.

The water may be conducted in pipes of lead, iron or wood, the same which are used in conducting water to your house for domestic purposes. It is preferable to use pipe two or three times larger than is absolutely necessary to give the requisite volume of water and the following statement may be used as a guide as to the size of pipe required:—"A straight cylindrical pipe, one inch in diameter, inclined one foot in ten, will convey about eleven gallons of water per minute. The same pipe, with an inclination of one foot in twenty, will convey eight gallons per minute; with an inclination of one in fifty, five gallons per minute; with an inclination of one in one thousand, one gallon per minute. A two inch pipe will convey about 5½ times as much water as a one inch pipe; a three inch pipe nearly fifteen times as much." Angles or bends in the pipe will materially reduce the capacity. A square conduit, made of boards or planks well jointed, does as well as anything else to conduct water, and if spring water, can be laid on the surface of the ground, reducing the temperature slightly, to its advantage. A perforated zinc or copper strainer with much more surface than the size of the conduit is preferable for the intake, but an ordinary packing box perforated with small holes and connected with the conduit will do. Any spring should be thoroughly cleaned out before the water is conducted to a hatchery and cleaned before each hatching season. The intake should be examined occasionly to guard against its becoming clogged.

While not essential, it is desirable to have the hatching room well lighted to avoid the necessity of using artificial light

in working over the eggs or fry. No artificial heat is necessary in a hatchery supplied with spring water, but if the water gets below 36 degrees in temperature, artificial heat may be necessary to prevent its freezing over the surface in the troughs. There is no objection to artificial heat for personal comfort.

In selecting a site for a hatchery, place it far enough from the intake to secure a fall of five or more feet to the floor of the building. The object of this is to raise the troughs about two feet from the floor for convenience in working over them. Bear in mind the heavy snows of winter and high waters, that the building may not be inundated.

HATCHERY BUILDING.

A simple house may be built at small expense with a plain shed roof. Use rough boards, 12 inches by 1 inch, and cover joints with 3 inch by 1 inch battens. The roof should be made water tight. There should be a drain underneath the building to conduct the water from the waste pipes. The outside should be well drained around the bottom. A building 16 ft. by 9 ft. will accommodate a pair of troughs 12 ft. long placed side by side in the center and one additional trough against the walls on each side.

EQUIPMENT.

Figure 1 shows the arrangement of troughs in pairs, side by side. Figure 2 shows how the troughs could be arranged so that the second trough would utilize the same water as the first one. In large hatcheries the troughs are frequently set in pairs, each pair emptying into a second pair to economize water and space. These troughs can be made of any good sound lumber; pine is preferable. If there is to be but one or two troughs, the supply trough, B, can be made out of half a kerosene barrel, burned out, with spigots inserted the same as in supply trough, figure 1. The supply trough should be arranged with an overflow to carry off surplus water as in an ordinary watering trough or by a dam, e, figure I, the upper edge of which is one inch below the top of the supply trough. To regulate the supply of water flowing into the hatching troughs a simple arrangement is shown in the water gate, c, and Figure 3. Make the waste pipe, f, larger than the supply pipe. If this waste pipe is extended through the bottom of the supply trough to within an inch of the top it will take the place of the dam, e. The plan shown in figure 1 is designed to show a more elaborate supply trough which can be extended indefinitely, until it embraces a series of hatching troughs. Make the supply trough six inches

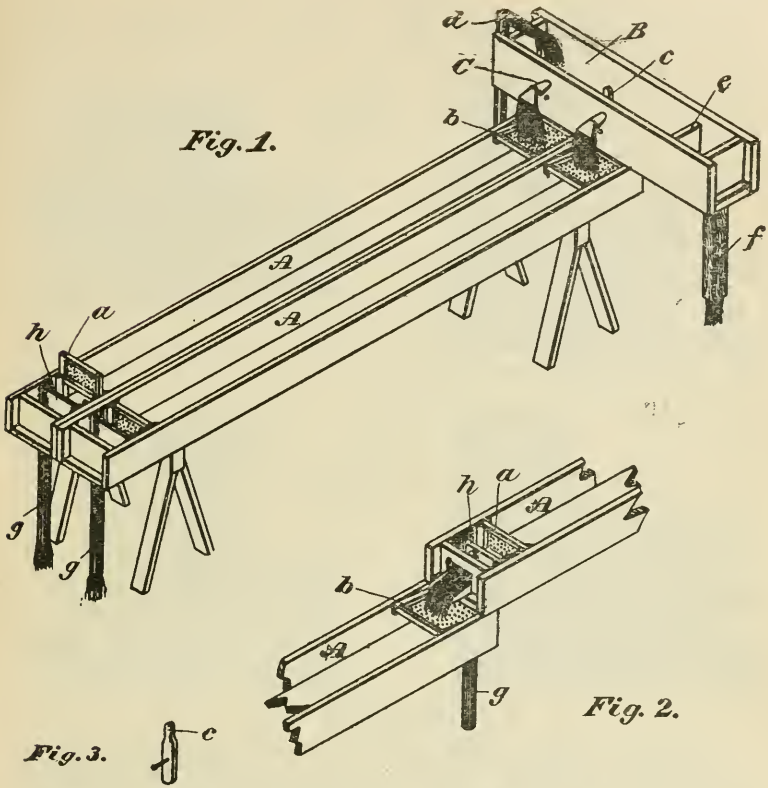


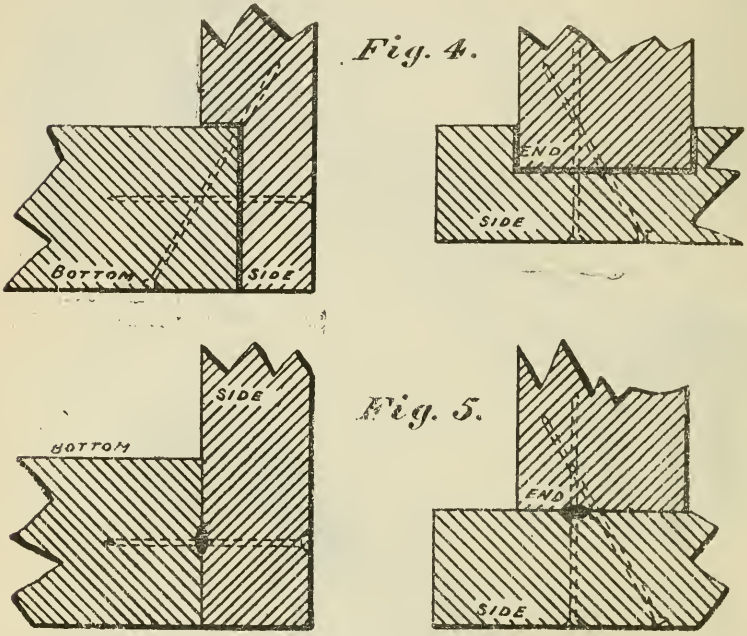
Figure 1. A A, Hatching Troughs. B, Supply Trough. C, Spigot. a, Tail Screen. b, Aerating Screen. c, Water Gate. d, Supply Pipe. e, Surplus water overflow. f, Waste pipe water Trough. g g, Waste pipe to Hatching Troughs. h, Slash Board.

Figure 2. Sections of troughs, A A, set tandem. Figure 3. Water Gate.

longer than the combined widths of the hatching troughs, allowing four feet for aisle space between each pair of troughs. If only one pair of hatching troughs are to be set up side by side, the combined width of which is 30 inches, make the supply trough 36 inches long. If a second set of troughs are to be set up the supply trough should be 9 ft. 6 inches over all. It should be 10 or 12 inches wide and not less than 10 inches deep.

Bore the spigot holes 6 inches from the bottom of the trough and see that the centres of all spigot holes are in line. The supply trough should be set perfectly level and then if the spigot holes have been bored to a line, a uniform flow may be expected from each spigot.

TWO METHODS OF MAKING WATER TIGHT JOINTS.



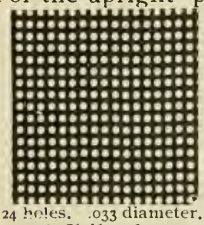
Figures 4 and 5.

To secure a water tight joint in the troughs, I suggest one of the methods shown in figures 4 and 5. The best but more expensive method is by gaining the pieces together as shown in figure 4. If no mill is accessible with suitable machinery for doing the work, the method shown in figure 5 is recommended. The stock having been cut to the exact dimensions required to build the troughs, the edges are to be grooved by depressing the wood instead of having it cut out. A tool can be made for this purpose out of a peice of heavy sheet iron, ⅛ to 3-16 of an inch thick and 6 inches long, then rounding one edge with a file. To depress the groove, drive the round edge of the grooving tool into the central line of the edges about ⅛ inch deep. Having made all the grooves, put the trough together, inserting into the grooves, a string of round wicking, dipped in lead paint. The wicking can be dispensed with by getting out the stock about ⅛ inch wider and then groove as above. Plane off the grooved edge 1-8 inch making it flush with the depressed portion. If there are any leaky joints, the depressed groove will swell and stop them. The method of jointing the supply trough and hatching troughs is the same. The specifications contemplate a pair of troughs

made of clear pine stock for a permanent hatchery. Length of hatching troughs 12 to 16 feet. Sides to be made out ot 1½ inch stock planed on both sides. The bottom and ends can be made of 1½ inch stock but I prefer 2 inch stock. Depth of troughs inside, 5 to 8 inches. If the fish are to be planted before they must be fed artificially, a depth of five inches is sufficient. The width of the troughs inside should be the same for all, and for economy in cutting tray cloth, make it exactly 13 inches.

Make the hole for waste pipe, g, figure 1, large enough to insert a 1½ inch pipe. Put this 2 inches from the lower end of the trough. Two inches from the outlet pipe or four inches from the lower end of the trough, nail two cleats vertically on each side, in which to slide the slash board or dam, h, figures 1 and 2. Eight inches from the lower end of the trough, put in two more pairs of cleats in which to slide the tail screen, a. Allow 1 1-8 inches space between the cleats. Make the cleats out of ⅝ inches square stock. The slash board, h, is 12¾ inches long, 3 inches wide and 1 inch thick. Two additional cleats are required at the head of the trough, far enough below the edge to support the aerating screen, b, so that it will be flush with the top of the trough. If the troughs are arranged to set tandem as shown in figure 2, they are built and equipped exactly as described above except that in the head trough a plug is required for the waste pipe h, and an outlet hole through the end of the trough is necessary. If a trough 5 in. in depth, cut out a square in the end of the trough, 4 inches wide and 3 inches deep. Make a tin lip to convey the water from the first trough to the second one. A sheet of tin from a tomato can will do for this purpose. Use lead paint under the tin before tacking it on. If the trough is more than 6 inches deep inside, I advise cutting out a hole in the end instead of notching down from the top.

Make two screens like figure 8, 12¾ inches by the depth of the trough inside. If the trough is 8 inches deep inside, make the frames of the screens 8 inches x 12¾ inches outside measure. For the upright pieces of frames, use 1 inch square stock and for the top and bottom pieces, use 5-8 inch x 1 inch stock, nailing the thin sides of the top and bottom pieces to the end pieces as shown in figure 8. Cover the frames with No. 9 zinc, perforated with holes, 324 to the square inch, .033 diameter. A frame 12¾ by 8 inches, requires a piece of perforated zinc 7½ inches by 11¾ inches.


324 holes. .033 diameter.

While the perforated metal is more expensive than wire cloth it is far more durable and is more easily cleaned. If on account of expense, wire cloth is to be used for these two screens, get material described as "24 by 24, number 24 galvanized wire cloth."

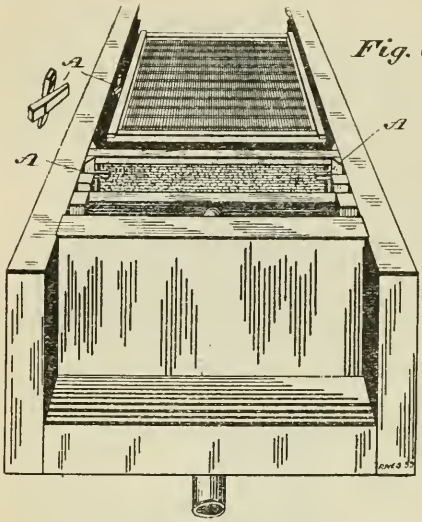


Fig. 6.

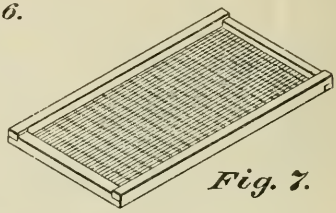


Fig. 7.

Fig. 8.

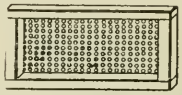


Figure 6. Section of Hatching Trough, showing method of wedging a hatching tray and tail screen in place.
Figure 7. Hatching Tray. Figure 8. Tail and Aerating Screens.

For equipping a large hatchery it would be best to obtain for the aeration screens a metal with coarser perforations than for the tail screen, but in fitting up only a few troughs it will be cheaper to make the two screens alike. To the one used as a tail screen, tack two thicknesses of flannel or several thicknesses of cotton cloth on the edge which comes in contact with the bottom of the trough. This insures against escape of the alevins under the screen. If you wedge the screen on the back side as shown in figure 6 at A, A, pressing it firmly down at the same time, you will secure a tight fit in the trough.

The object of the aerating screen is to spread and aerate the water and break its fall on to the fish in the trough. It also acts as a cover for that portion of the trough where it is placed.

Make the hatching trays, figure 7, 12½ inches wide and 18 inches long, outside measure. Use for sides, pine, ⅞ inch by ⅞ inch and for ends, ⅝ inch by ⅞ inch. Mortise together as shown in figure 7. Cover with "galvanized wire cloth, 2x9 mesh, No. 24-23 double warp." This wire cloth is manufactured 24 inches wide and can be halved to fit the trays. For a tray 12½ by 18, cut the cloth 12 by 17½.

The wire cloth or perforated metals can be purchased of the Clinton Wire Cloth Co., Clinton, Mass. Perforated metals are also manufactured by the Harrington & King Perforating Co., Chicago, Ill.

Perforated zinc costs about 40c. per square foot. Double warp cloth, galvanized, costs about 8c. per square foot. 24 mesh galvanized wire cloth costs about 10c. per square foot. Prices on all dependent upon the quantity purchased. In ordering perforated metal, give the size of pieces required, in order that the stock sent you can be cut economically.

Use 3 oz. copper tacks to fasten perforated metal or wire cloth on to frames. If not easily obtainable, use 3 oz. tinned carpet tacks. Most all of the stock required in making trays and other equipment can be gotten out of the waste lumber from the troughs.

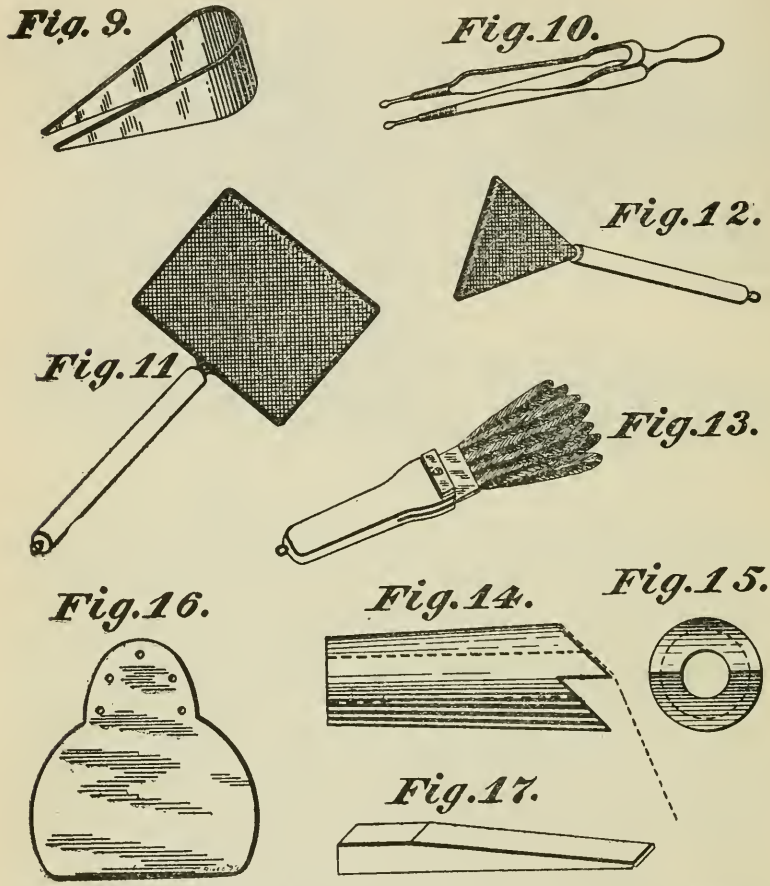
PAINTING.

Paint troughs inside and out, and all trays and other equipment which comes in contact with water, with two coats of turpentine asphaltum paint. A suitable quality of paint costs from 50 cents to 60 cents per gallon.

TOOLS.

Having equipped a hatchery connected with a constant and suitable water supply, you are ready for the eggs, but there are some hatchery tools which will be convenient, most of which you can make yourself. Figures 9 and 10 show two forms of egg pickers with which to pick out dead eggs. Figure 9 is made by taking a piece of galvanized sheet iron about 22 guage and cutting it into a strip about 12 inches long, 1 to 1½ inches wide at the centre and tapering to about ⅛ in. wide at each end. Bring the two ends together, as shown in the figure. Figure 10 is a more elaborate form of picker made by cutting the tweezers out of a solid piece of clear pine about 6 or 7 inches long and attaching to them some fine wires with rings at the ends about ⅛ inch in diameter. A more simple picker can be cut out by trimming down a clothes pin or cutting plain wooden tweezers out of a piece of pine. Nearly every fish culturist makes a picker to suit himself.

Figures 11 and 12 are scarf nets used for picking up eggs or fry and for cleaning troughs, etc. The rectangular net should be about 10 inches wide by 9 or 10 inches deep. It is made by bending a wire into the form shown, fastening the wire to a light handle and covering with mosquito netting or bobinet. The bobinet is preferable and costs from 45 to 75c. per yard, 54 inches wide. The side of the wire frame opposite the handle should first be covered with some coarse material to which the bobinet can be fastened. This is because the bobinet would wear out too quickly if sewed directly to the bottom of the frame. The triangular net, figure 12, is much smaller than the other and does not require so heavy a wire frame; either 4 or 5 inches to a side is a good dimension to follow.



Figures 9 and 10, Egg Pickers. Figures 11 and 12, Scarf Nets. Figure 13, Feather Brush. Figure 14, Side view of Spigot. Figure 15, End view of Spigot. Figure 16, Tin Hood for Spigot. Figure 17, Wedge.

Otherwise, it is made by the same method as the larger one. It is well to paint the wire before covering it to prevent rusting. Figure 13 shows a feather brush made by slitting the end of a piece of wood with a fine saw, inserting tail feathers of a crow and fastening in place with a small stove bolt. The handle is about 6 inches long by ½ in. thick, cut in the form shown. In addition to the implements shown, it is well to have some extra feathers either from the wings of a barnyard fowl or the tail feathers of a crow. A rectangular pan 14 in. by 20 in. and four inches deep, bound at the edge with wire, is a very handy implement in transferring eggs from packing trays to

hatching trays and in many other ways. The sides and one end of the pan are to be perpendicular to the bottom, the other end flares like the side of an ordinary milk-pan.

The ordinary No. 2 bench brush, more commonly called in the kitchen a dust brush, and a palmetto scrub brush are convenient tools which can be purchased at the stores.

The spigot, figures 14, 15 and 16 is made as follows: Make a round plug of clear pine, 2½ inches in diameter at one end and tapering to ¾ inches at the other, 6 inches long. Bore an inch hole through it horizontally. Notch as shown in figure 14. Cut a piece of tin into the form shown in figure 16, the upper portion to fit the end of the spigot as notched, the lower edge about 4 inches wide. The tin is tacked to the end of the plug, producing the effect shown at C, figure I. The tin hood can be bent forward or back to direct the flow of water on to the centre of the æration screen. A wooden cider spigot with an inch hole would serve the same purpose.

Figure 17 shows a wedge. Make it out of ½ in. square stock or dimensions approaching that size and from 4 to 5 inches long. You will need two wedges for the tail screen, two for the slash board and two for each hatching tray. The method of wedging the hatching tray so as to hold it in place above the bottom of the trough is shown in figure 6, A. By this method, the tray can be suspended at any height in the trough and is used most frequently where roily water is encountered. As water has been selected which is not going to be roily, I will describe another method of setting the hatching trays in the trough. Drive two 4d wire finish nails into the opposite corners of one end of the tray and two 6d nails into the opposite corners of the other end. Drive them in just enough to be firm and so that all four legs thus made will rest firmly on the bottom of the trough. When the tray is set in the trough, put the shorter legs towards the head of it and wedge the tray firmly into place on one or both sides. All these preparations should be made before the eggs are received. I have written quite in detail to prepare you for the reception of the eggs for it is these details which must be looked after in fish hatching and much more might be said.

HOW TO OBTAIN EGGS.

These may be purchased from commercial fish culturists of whom there are many in New England. Eggs are shipped after they have been "eyed" and they are then called "eyed ova" to distinguish them from green eggs or freshly taken eggs which are not transportable until they have arrived at a stage of development when the eye spots are visible through the shell of the eggs. Eyed trout ova can be obtained from November to February and

are shipped across the continent or even to European countries without damage. The eyed eggs will come by express packed in a box of moss. The eggs themselves will be upon flannel trays covered with moss. Between the moss and the eggs is mosquito netting. Pass a dairy thermometer into the moss covering the eggs and see if it varies much in temperature from the water into which the eggs are to be laid down. If there is a variation of more than five or six degrees between the temperature of the eggs and the water into which they are to be introduced, drench them a few times with water in order to gradually change their temperature to that of the water. Do not be in too much of a hurry about this work. When satisfied that there is little variation between the temperature of the eggs and the water, roll back the mosquito netting with the moss in it and you have a clean tray of eggs. Hold this over the large square pan containing hatchery water and then pour out gradually from a dipper into the tray enough water to gradually wash the eggs from the tray to the pan. Repeat this operation with the several trays until all are emptied into the pan. There will be more or less dirt and floating particles in the water with the eggs. Pour off some of the water—all that will run off without taking eggs with it. Fill the pan with water and repeat the process of pouring off water until the eggs are comparatively clean. Then, while the egg trays are floating on the surface of the water in the trough, pour out a portion of the eggs on to them. It will be well for you to have an assistant to hold the tray until you have become experienced. Shake the tray gently to distribute the eggs singly over it. Where large shipments are unpacked, it is desirable to establish a measure for each tray and then pour from the pan to the measure and then to the tray. A graduated tin dipper will do for a measure. Having filled the trays with eggs, lower each slowly into the water until its legs rest firmly on the bottom of the trough ; then, while holding the tray in place with one hand, wedge it firmly with the other. The eggs can now be left until the following day, when, if there are any dead ones, they will have turned white and must be picked off. This can be done with your pickers without disturbing the other eggs on the tray. From now on until the eggs begin to hatch, I would advise picking out any dead eggs daily, although once in two or three days may do. If the eggs are neglected, a fungus growth will appear on the dead ones and quickly envelop the others. Observe the water supply every time you enter the hatchery. See that it is constant and that the eggs are not becoming covered with sediment. If there is sufficient water to flow more than two gallons per minute to a trough, flow as much as can be run without causing a current strong enough to disturb the eggs on the trays. Even if the eggs at the head of the trough are washed a little, it will do no harm

during the latter stages of development. There will, of course, be no sediment because you have selected a water supply that is free from it, but, if through some unforeseen accident the eggs become coated with sediment to such an extent that you cannot distinguish the eye spots, they should be cleaned by pouring them off into the large square pan and rinsing them by the same process as when they were unpacked. A quick turn of the tray over the pan of water will empty it without the loss of an egg. Wash the trays thoroughly before returning them to the troughs and brush out all sediment in the troughs. Use a cloth or soft brush to wash trays as the asphaltum paint is easily scratched off.

Development of Trout Eggs and Fry.

When the fry begin to hatch, they burst the shells of the eggs and emerge tail first, wriggle themselves out and pass down through the wire meshes to the bottom of the trough. As soon as all the eggs have hatched, the trays can be removed. The egg shells must be feathered out to the lower end of the trough and finally brushed out over the tail screen, care being taken not to injure or brush out fry at the same time. Cripples, deformed ones and dead from unknown causes will be picked from the trough daily by use of the small scarf net and pickers. The eggs develop first into fry with an abnormally large stomach, called the umbilical sac, which is their "bread basket." This sac is gradually absorbed until the fry appear like the one illustrated with almost no sac at all. At this period or soon

after, it begins to rise to the surface of the water for food and snaps at floating particles. Unless you intend to feed the fry and rear "fingerlings," I advise you to plant them when you see the first one develop any symptoms of hunger, or just before the sac is entirely absorbed. You will then have carried the eggs and fry through the least trying period of their existence and brought them to a suitable age to plant with fairly good results.

TRANSPORTATION AND PLANTING OF FRY.

If the waters to be stocked are near the hatchery, it may be well to plant only a few each day, choosing the most active and farthest developed ones. They can be transferred from trough to pail or can on the scarf net without injury. At this stage, a third scarf net made like either of the others except that the netting should bag a trifle is useful. If attempting to stock a pond and there are any tributary streams or any springs flowing into it, plant at least a part near the springs. In stocking streams, the same care in distributing fish should be observed, viz: that the fry should be well scattered and placed in spring rivulets which do not dry up.

If the fish are to be transported a considerable distance, put them in clean milk cans holding about ten gallons of water for every three thousand fry. Five thousand can be carried but the less crowding the better. Keep the water well iced. When the cans are not kept in motion on the cars or in the wagon, aerate the water constantly by dipping it from the can and then pouring it in again from a height of a foot or so from the top of the can. Should there be a variation of more than six or eight degrees in temperature between the water in the cans and the water in which the fry are to be planted, dip water from the can and from the stream or lake into the can until the temperature of water in the can is brought to that of the stream or lake. Do not, under any conditions, leave the can standing in the sun or allow it to sit still more than five minutes unattended.

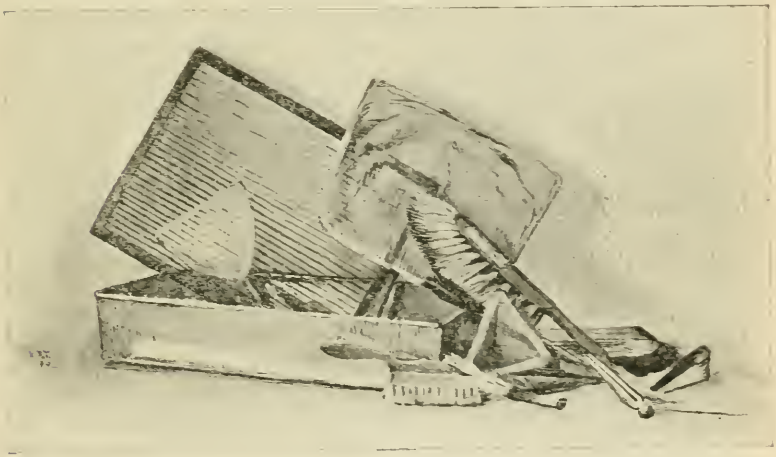
CONCLUSION.

The cost of two hatching troughs, with all necessary equipment for hatching 80,000 to 100,000 eggs should not exceed the $18.50 mentioned early in this chapter. The expense of constructing a hatchery building if that is necessary or of conducting a water supply to the hatchery is not included in this statement. If you wish to make only a temporary experiment, construct a trough of clear spruce boards. Use a barrel for a supply trough. Melt a couple of tomato cans and perforate one sheet of

tin thus obtained for an aeration screen and cut up the other to make a lip to conduct water from the barrel to the hatching trough. Buy some good material for a tail screen and see that it fits tightly in place. You must also buy the wire cloth for hatching trays. Paint all equipment as carefully as if following the specifications for pine wood troughs of thick stock, using asphaltum paint.

40,000 eggs can be hatched with an equipment that ought not to cost more than two or three dollars after the water and protection from the weather have been provided for. There will, of course, be some loss in eggs and fry before they are planted. If the water is all right and the eggs are vigorous ones, from 80 per cent to 95 per cent of them should be hatched to plant as fry.

JOHN W. TITCOMB.



DAIRY BARNS.

By Ernest Hitchcock, Pittsford, Vt.

It is not the purpose of these remarks to enter into any discussion of architectural or engineering problems in barn construction, but merely to give a few practical hints as to the best arrangement of barns and stables for the convenient and healthy keeping of cows. It may be said in passing, however, that there is no necessity for the use of heavy and expensive timbers in the erection of even large barns. The plank frame barn is an unquestionable success. It depends simply upon the great strength of even small timbers when subjected only to a *pulling* strain. Such a frame can be so put together that it is practically all in one piece and so that, to be destroyed, the plank must be pulled apart lengthwise.

Most barns now being constructed are of one of two forms, octagon or T shaped. I have never seen a plan of an octagon barn which fully commended itself to me. If I were to build a new barn to-day I should unhesitatingly use the other form, of which a very fair illustration was given in last year's report, page 70, (18th Vt. Ag. Rep.) Of course the size and many details will necessarily be varied to suit individual cases. The general plan is almost universally applicable. Further, in many cases, it offers the best suggestions for remodeling old barns, the present barn being used for storage and the stable being added new as an ell. The plan consists, in its essentials, of the construction of a main barn to be used for storage of hay, silos, grain, etc., and a stable, one story only, built off from the centre of the main barn in form of a wing. The main barn should run east and west if possible and the stable project to the north. In this way the morning sun will flood the east half of the stable, the afternoon sun the west half, insuring the presence of the sun in every part of the stable for some considerable portion of each pleasant day,—a consideration not to be overestimated. Provision can be made for caring for the manure in either of three ways. If the herd is a large one the cattle can be tied facing the walls with a driveway between and the manure hauled to the field every day,—in some respects the best possible method. Second, a cellar can be put under

the south end of the stable and the manure dropped into that and hauled out at one's convenience. In this case the floor over the cellar must be air tight and abundant ventilating shafts be run from the cellar up *through* the roof of the stable so that there can be no danger of foul odors and gases in the stable. Some authorities condemn this method without reservation but I believe that with proper precautions it may be safely practiced. The third method is to wheel the manure daily out into a shed built for the purpose. This involves more labor than the other methods but is probably no more laborious than the method, so fashionable in many places, of throwing it out of a small high window to lie under the eaves. This last method is, in every case, extravagant and inexcusable. If you have no possible place to store your manure, and are unable to provide one, wheel it away from the barn to a place not under eaves and not subject to surface wash and dump in a pile. Make your pile to cover quite a surface, keep the top level and packed down and the waste will be a small part of what it would be in a conical pile under the eaves of the stable.

Coming now to the main part of my suggestions on this topic, the interior arrangement of stables, I observe that there are three principal considerations to be observed. In the order of their importance they are: 1st, the health of the cows; 2nd, the comfort of the cows; 3rd, the convenience of attendance.

The first condition of health is pure air. The size of the stable must be adequate to the number of the cows. Probably more stables lack in this respect than in almost any other. In our climate from seven hundred to a thousand cubic feet of air should be allowed to a cow. A stable thirty-five feet wide, ten feet high and with an average allowance of four feet to a cow in length of stable is about right for two rows of cows. This does not mean that four feet must be allowed to each tie up but that the entire stable, including alleys, box stalls, etc., average that. Now in securing an adequate supply of pure air it must be remembered that a cow does not consume air as she does grain or ensilage. The cow can utilize only a portion of the oxygen in the air before it becomes too foul to breathe. Hence provision must be made for the introduction and exit of an enormous bulk of air. It has been estimated that 1400 cubic feet of air per cow per hour is none too much to move into and out of the stable. Of course ventilating shafts vary much in their efficiency but if we estimate the motion of air in a shaft at two and a half miles per hour we reach the conclusion that a shaft one foot square inside measurement is needed for each ten cows as an outlet. These outlets should start from near the stable floor and go by the most direct route possible to the highest point of the roof and *up through the roof.* Inlets for air should open out-

side near the ground, go up inside the outer wall of stable and open at ceiling of stable. Care should be taken that no direct draft can strike the cattle.

A single ventilating flue, D E, rises above the roof of the main barn and is divided below the roof into two arms, A B D, which terminate at near the level of the stable floor at A A, These openings are provided with ordinary registers, with valves, to be opened and closed when desired. Two other ventilators are placed at B B, to be used when the stable is too warm, but are provided with valves to be closed at other times. C is a direct 12-inch ventilator leading into the main shaft, and opening from the ceiling, so as to admit a current of warm air at all times to the main shaft to help force the draft. This ventilating shaft is made of galvanized iron, the upper portion being 3 ft. in diameter. The covering on the outside is simply for architectural effect. The air enters the stable at various points as shown in the plan at F G, and in the vertical section by arrows at F G.

Sliding doors can take the place of registers and board shafts the place of galvanized iron. Next to pure air, and fortunately equally cheap, comes sunlight in its effect on the health of cows. The location of the barn with reference to the sun has already been mentioned. An abundance of windows is the only other condition for the plentiful admission of this great life and health giving agent. Its value cannot be overestimated. Its presence means a short life for injurious bacteria. These thrive best and survive the longest with darkness and dampness. Windows therefore should be of large size and in goodly number. Basement stables are usually objectionable because they lack in height, ventilation and windows and often because of dampness. If these conditions can be met they are not objectionable in themselves.

The comfort of the cows is the next consideration in the planning of our stables. A reasonable degree of warmth is essential to this but it is unnecessary to go to an extreme. Observation of the cows will be the best guide. If the hair is rough, if they stand curled up and shivering obviously a change is called for. No precise degree of temperature can be prescribed but a stable which in the coldest nights does not get below 40° will I think be found satisfactory. To attain this windows and doors must be tight. Cold drafts are especially to be avoided, being much more objectionable than a low general temperature. The use of building paper is the one cheap practical method of securing warmth. It is, both for houses and barns, one of the most valuable introductions of comparatively recent years. A covering of good paper properly protected by lumber, adds more to the warmth of a building than an extra sheathing of boards. It also enables us to use a cheaper grade

of lumber. In old buildings paper of good quality can be used on the inside without covering with boards. Its cheapness and easy use render the exposure of our cattle to the weather utterly inexcusable. Ceiling on the inside, leaving a dead air space, is desirable and, in exposed locations, perhaps necessary. It can be done with high priced and ornamental lumber if the pocket book warrants the outlay. If not two thicknesses of the cheapest half inch lumber with paper between is just as warm, probably warmer. Wooden shutters for windows, to be closed in cold nights, are desirable as the experience of our poultry friends has amply taught. Glass is a source of warmth in the sunlight but in the night time serves only to rapidly radiate warmth without in the least purifying the air. The shutters therefore are a clear saving.

Ties open up a wide field which can only be touched upon. The old fashioned rigid stanchions have held many good and profitable cows through many a long season and is probable that the cows could not have suffered much or such good work would not have been done. Still we believe there are better ties. Which is the best no one knows. Every agricultural paper is full of cuts and descriptions both in the ads. and the reading matter. Three general classes are offered. The patent stall in which the cow stands entirely free ; swinging stanchions of one device and another ; and tying by a rope from head or neck. Investigate all methods and adopt the one best adapted to your needs. Combine and improve and pay out nothing for patent rights. I have no hesitation however in urging that whatever *tie* you use, each cow be separated from her neighbour by a partition. The single item of saving in cows teats being stepped on by neighbours more than pays the extra expense. It requires a little more room but not more than the cow should have for reasons of health.

Cleanliness must also be mentioned as one of the necessities, both on account of the health and comfort of the cow and the quality of the product. The gutter should be not less than eighteen inches wide and eight inches deep and cleaned at least once a day. The width of the platform is important. It must be adapted to the length of the cow. If too short it is liable to injure the cow, especially when well along in pregnancy. If too long cleaniness is impossible. Where the stall is used this can be arranged by having the manger wall next to the cow movable. If this is not desired make the platform longer at one end of the stable than the other and arrange cows according to size. Walk behind the gutter should be not less than three feet and better four or five feet wide. Nothing tends more to render the care of a herd of cows a nuisance than the absence or narrowing of this space. Without it no one can take comfort

or pleasure in the care of his cows. Use bedding if you have it, dry sawdust is almost a necessity in the gutter and on the heel plank. With all precautions some cows will persist in dropping their manure and urine nearer the manger than the gutter. For such reprobates a board across the stall just clearing the back as they stand naturally and twelve to fifteen inches back of the shoulders will often act as a forcible remider to the cow of what propriety demands. Mangers should be so constructed that the food of all kinds will come easily in reach of the cattle. Some have discarded the manger entirely and pronounced the innovation good. It certainly makes it easy to keep the feeding place clean but personally I should fear that cattle might injure their knees in trying to secure fodder they had thrown out of their reach.

Water constantly before each cow is a mooted question. Some have introduced it and discarded it,—our experiment station among others. In my own stable I have iron buckets before each cow and while I admit the objections (chiefly cows slopping in the manger and throwing food into the water) I think they are outweighed by the advantages. The objection of danger of spreading disease, tuberculosis in particular, I do not weigh at all. The only safety from this is to keep the entire herd perfectly sound. Then no system of watering or feeding will spread it. If a contagious case exists no precautions practicable will prevent its spread. If you wish to introduce this system make your own pattern, take it to the nearest foundry and get your buckets cast at 2½ cts a lb. No patent valves are worth fussing with. The man who has not sufficient ingenuity to devise and arrange his own system of watering should be a dry goods clerk and not a farmer. A good many water twice a day in the manger, the manger being made of cement for this purpose. This has the important advantage of compelling cleanliness. Another method I have seen in satisfactory operation consisted of a wooden trough on top of the manger with a stream of water constantly running through it. This was covered and in front of each cow was a section of the cover on hinges. The cows quickly learned to put their noses under a projection and raise this cover to drink. It fell back of its own weight.

The floor of the stable, in my judgment, if on the ground floor, may best be made of cement. It is permanent. It is water tight, preventing the waste of manure. It absorbs no liquids to give out bad odors. As there is no chance for drafts under it, it is probably warmer. As much of the labor in putting it down can be done by the farmer, his own men and team, the cash expenditure will often be less than for a plank floor. Directions for doing the work have so often been printed it is usless to repeat them here. One caution,—don't economize in the

quality of cement. Cheap cement is an extravagance. Use the best and it will be the cheapest and most satisfactory. The main condition of success is a firm and immovable foundation. If this is secured a comparatively thin coating of concrete on top will last forever. Perfect drainage is also an essential to success with this floor.

Convenience of attendance depends so much on individual surroundings and conditions that little can be said of a helpful nature. Wide alleys, plenty of floor space in the stable, accessible silos, hay mows and grain bins, these are the main things to be considered. They will be most certainly secured by taking plenty of time to *plan* the barn.

Just a few words as to remodeling old stables. In the great share of our Vermont stables the things to be attained by change are first, cubic air space ; second, sunlight ; third, warmth; fourth, ventilation. Windows will give the second, building paper the third and a few boards put into the shape of a ventilating shaft the fourth. The expense of all these will be trifling. The cost outgo will be small and the labor not great and of a character that every farmer can do himself. The first, cubic air space, is perhaps the most important of all but it unfortunately is often more difficult and expensive of attaiment. As a general proposition width can most cheaply be secured by a leanto built upon the side. Height can often be secured by removing the floor and replacing it with cement a foot or more lower down. Or, in many cases, height can be easily gained by raising a scaffold one or two feet. The *best* method will usually be to build an ell of one story, and place stable therein. If none of these, or other methods are possible to secure proper size, then make the means of ventilation as ample as possible. Ventilation however will not fully remedy the difficulty. No system of barn ventilation, without artificial heat is *fully* satisfactory. And of course artificial heat is out of the question for most of us. It is for this reason that a good amount of cubic air space is so important.

In conclusion allow me to say that I have endeavored throughout these remarks to keep constantly in mind the matter of expense. I believe nothing has been advocated herein that is not well within the means of every Vermont farmer living on his own farm. Certainly no such farmer can afford to keep his cattle in a stable that is not reasonably healthy, convenient and comfortable. No man should be a dairy farmer who does not take pride and satisfaction in his herd and next to the quality of the cows themselves nothing contributes more to the satisfaction of their owner and attendant than the character of the stable in which they, and their caretaker as well, spend much of the time of our long Vermont winters.

HORTICULTURE.

FERTILIZERS IN HORTICULTURE.

JOSEPH L. HILLS.

The plant food problem is one of considerable importance to Vermont horticulturists. Their soils have been for many years more or less depleted, and natural or artificial fertilizers need to be used. Plant food is evanescent, it slips from the grasp readily, its saving is worth consideration and its more rational use deserves notice ; but in the short space which can be devoted to this matter in this report one must of necessity be brief.

There are three general channels of loss of fertilizing ingredients, two of which are natural and one artificial. In the first place, nitrogen is lost through fermentation, leaching and drainage, while phosphoric acid and potash pass off by leaching ; in the second place there is much loss caused by the mechanical processes of nature, the attrition and denudation of soil surfaces ; and, in the third place, man is responsible for considerable amounts of shortage by his incorrect methods of cropping the soil. There is a serious danger of shortage of plant food in the not distant future unless new methods for its formation be found, or modification of current methods of use be adopted. It behooves us, therefore, so far as possible, to prevent waste, to render the plant food which lies dormant in the soil more readily available, and, in general, to study the problem thoroughly that we may be better informed. Space forbids, however, opportunity for discussion of this matter at present.

The three ingredients more particularly needed in our fertilizers are nitrogen, phosphoric acid and potash. The functions of these three ingredients in horticulture, and, indeed, in agriculture generally, are essentially as follows : nitrogen tends to increase or to improve the foliage of the plant, often, however, at the expense of early fruitage ; phosphoric acid, on the contrary, tends to hasten fruitage ; while potash aids in the formation of starch and sugar and has a notably favorable effect upon the pulpy portion of fruits. It should be understood, of

course, that all of these fertilizing ingredients are necessary for the successful growth of the plant. No plant could mature in the absence of any one of them, or, indeed, of several others. The points noted above, however, indicate their special functions as observed in practice. It would be very satisfactory if the agricultural chemist were able to prescribe specifics for our plants as does the doctor for our ills. Were we able to say absolutely that just such a fertilizer combination would be best adapted to a certain plant upon a certain soil, things might be better; but so many conditions come in to modify results, and information, what there is of it, is still so lacking and conflicting that the advising of specifics is not safe. The only thing which can be said with entire safety is that it is wise as a rule to feed liberally of available forms of plant food for that class of crops which are to be grown quickly, and of relatively unavailable forms for those growing more slowly.

Let us take up now briefly the consideration of fertilizers in relation to market garden crops and to the fruit crop.

The market gardener wishes above everything else large yields, in proportion to area, of particularly fine quality. His goods need to appear well, should be succulent and sweet and free from bitterness or stringiness. This necessitates continuous and rapid growth. There are many conditions, of course, which are beyond his control, but, given a good soil and a favorable season, the most available plant food in liberal amounts is on the whole the best practice. A reasonable excess of all three of the fertilizing ingredients should be applied as a basis for all the crops, and then one element or the other should be added in greater excess according to the nature of the crop. Nitrogen is particularly indicated in foliaceous crops, such as lettuce, cabbage and the like ; phosphoric acid where the seed in particular is wanted, as, for instance, the ear of corn. Director Voorhees of the New Jersey station, who has given much study to this matter, recommends a formula for market-garden use in general of 4 per cent nitrogen (to be derived both from nitrate of soda and organic matter), 8 per cent phosphoric acid (to be derived from acid phosphate and ground bone), and 10 per cent potash (as muriate). He recommends this as a basal fertilizer, and to add for the specific needs of the plant by top dressing very generally in the form of nitrate of soda and muriate of potash.

The fruit grower is confronted by a somewhat different problem than is the ordinary farmer. The latter usually sows his crop in the spring and harvests it in the fall. The fruit grower on the contrary grows his crop for several years before he harvests. He must fertilize in the first place for growth without expecting fruitage, and afterwards for growth and fruitage

coincidently. Another marked difference between the two classes of cropping is to be found in the fact that the farmer has to do with the rotation of crops while the horticulturalist has to do with a continuous crop. The latter thus loses the important advantage which the farmer is able to secure from rotation. Gradual and continuous growth is what is wanted. This would appear to be well provided for by a basal fertilizer of one part each of ground bone, acid phosphate and muriate of potash, or perhaps one and one-half parts of ground bone and one part of muriate. To this should be added at special times and seasons moderate amounts of quickly available plant food. Considerable amounts of nitrogen are to be discouraged, as they tend to cause too large a growth of wood, non-maturity, non-ripening and a greater likelihood of winter killing. As regards apples, in which a large share of Vermont horticulturists are interested, it may be remarked that an apple orchard takes from the soil more than does an ordinary wheat crop. An interesting experiment made by the Cornell Experiment Station some years ago showed that an acre carrying thirty-five trees, bearing for twenty years an average of fifteen bushels to the tree, lost twice as much nitrogen, one and one-half times as much phosphoric acid and three times as much potash as did a soil which grew twenty average crops of wheat. The use of either of the basal mixtures cited a few moments ago in amounts of four hundred pounds upwards a year would more than replenish this draft and keep the land in good heart.

The fertilization of the small fruits, such as berries and the like, should be carried out in much the same way as the larger ones, except that because of their nature a somewhat more available plant food is needed and in perhaps larger amounts. The general underlying ideas, however, are the same.

No one can say off-hand whether it will always pay to use fertilizers in horticulture. There are too many conditions coming in to render the matter an absolute certainty, just as is the case in ordinary farming. With some, one method of fertilization or one fertilizer will succeed where it would not with others, the reasons being, perhaps, that nature helps the one where it does not the other, owing to changes in conditions. It is thought, however, that, given a fairly good range of conditions, fertilizers wisely chosen in horticulture may be as helpful as in the usual branches of farming.

SMALL FRUIT CULTURE.

By Chas. A. Hinsdale of North Bennington.

I shall not attempt to describe all the operations connected with the culture of small fruits but will give my ideas on a few of the most important.

First we must consider the soil and its condition. Choose a spot that you think would be good for corn or potatoes and you will usually be safe. It may be sandy loam, clay loam or gravel, but don't try a swamp. It is not often that the land on which crops are planted is properly fitted, and it is especially necessary to have the soil in good shape for crops that are to occupy the ground more than one season. Of course the ease with which the work can be done depends largely on the character of the soil and the previous crop and here is a very important matter to the market grower, for if soil and conditions are such that the fitting is expensive, away goes his profit. Or he may be tempted to plant when the fitting is only half completed and that means extra labor in caring for the crop, or failure. Whatever you do, be sure that your land is well plowed and harrowed before you plant. When you have it harrowed in good shape, harrow it some more, then harrow again and drag it with a plank drag. I use the harrow until the soil is so mellow that it clogs in front, then the plank or board drag makes the field as smooth as can be and we can tell just how deep to plant.

We set strawberry plants with a spading fork. For most other plants we use either a cultivator with only one tooth or a plow but sometimes both plow and cultivator are necessary. By following the plow with the cultivator tooth the trench is made deeper and the soil at the bottom so loosened that the planter can push it aside with his hands if necessary. You can easily tell how deep a plant should go if you will examine it carefully. The distance apart to plant is a point which can be varied to suit the ideas and convenience of the grower and is not so important as many believe provided the after culture is suited to the manner of planting. Speaking generally, the closer you plant the more expensive will be the culture.

In doing the planting the soil will be more or less packed, and should it be left so and the weather be unfavorable, a great

deal of liarm may be done. The cultivator should be run between the rows as soon as the planting is finished and should be kept going very often till fall. We use two models, the five tooth and the harrow. The latter can be run very close to small plants without covering them, but great care must be used not to let the teeth go too deep. Nine men out of ten who have not had experience with such work will run the cultivator twice as deep as it should go when close to the plants. Be sure and go through with the cultivator soon after every rain. There is always a time when the soil is just right but if the weather is hot the proper conditions may last only a few hours and this condition often comes sooner after a heavy shower than one would think.

Summer training of the strawberry and pruning of the raspberry and blackberry is important. In growing the strawberry in matted rows it is best that the young plants should not be pulled up after they have commenced to root. The only way this can be avoided is to keep the cultivator constantly on the move for if we leave the field for a couple of weeks the runners will reach out into the center of the cuitivated space and when it rains the little plants will send out roots in an incredibly short time and these will be overturned by the cultivator and as a result their rooting will be greatly delayed. If you should be very busy and neglect the bed, turn the plants by hand and press them into the soil again, or if you haven't time go right along with the cultivator and let them shift for themselves. Do not stop the cultivator: If you do you will regret it.

Blackberries and raspberries should be pinched back when from twelve to eighteen inches high the first season and at about two feet when older. You will have to keep an eye on the new growth or some day you will find it has grown to be five feet high when you thought the growth had only commenced. The second season use the plow on all small fruit. With bush fruits throw the furrows against the plants early in the spring and after the weeds have been smothered, cultivate and hoe it away.

As soon as your strawberry plants have ceased bearing mow the bed over and burn or rake off the rubbish ; then turn your furrows on to the rows of plants leaving a narrow strip not covered. When this earth has remained long enough to kill the weeds and plants underneath, cultivate and hoe it back into the furrow again and then work the bed the same as the first season.

PROFITABLE VARIETIES OF APPLES.

By S. P. Gordon, Pearl.

Commercial orcharding requires quite a different selection of varieties from a selection for home use. In the latter case one may indulge in a great variety, as taste or fancy may dictate, but for sale for profit we are limited to a few varieties which must be possessed of certain characteristics; first, the trees must be hardy, productive and possessed of sufficient vitality to hold them up to a productive condition for a long time; second, the fruit must be good looking, good keepers and able to withstand shipment to distant markets, and of such good quality as to be in demand by consumers. But a few of the many kinds now grown to some extent can be depended upon for a commercial orchard. New varieties are constantly coming up, some of them of great promise, but they are not to be depended upon until they have been tried in different localities and their shipping and selling qualities become well known. Try them in a small way before giving them a place among the old standards.

Most of the leading varieties are sufficiently hardy for our purposes, so we need not sacrifice quality to secure trees that will live. I know of but two, the "Hubbardston" and "King," both good apples, but often so tender as to be unreliable. The "Easopus Spittzenburg" is tender in the young tree and is best raised by top-grafting on well grown, hardy trees. This makes it costly but the high quality and great demand for the fruit amply compensates for trouble; thus grown, it becomes a long-lived, productive tree, one of the best. For all-round good qualities the "R. J. Gunning" is the best apple we have. "Lake Champlain Greenings" are quoted in New York markets at the top of the best. It will grow in any soil not too wet, but to do its best it must have other varieties near to secure proper fertility of its blossoms.

A well grown "Northern Spy" is a fine apple; the tree is hardy but will only do its best on deep, rich, slaty soil. The fruit is late in maturing, often a large per cent does not ripen; it is not a good apple for general orcharding. The "Baldwin," like the "Greening," will grow on any soil; is a great cropper, fruit uniform, good keepers and shippers; it is one of the best for profit.

It is to be regretted that so poor an apple as the "Ben. Davis" has been so extensively planted, the quality is way below what our standard should be. It is a good tree and had better be top-grafted with some good variety.

The "Wealthy" may be a good variety for elevated regions where the old standards will not grow, but it is not worthy of a place in our Champlain Valley orchards. It is a very good fall apple here, but has the fatal defect of dropping its fruit just before maturing. The "Fameuse" is of such good quality both in tree and fruit, with the one defect of its liability to scab, that good orchardists will continue to raise it in commercial quantities. When neglected it is of no value. Only men who are willing to give the best of care and spray thoroughly will succeed with it. Clean, well grown fruit will always be in demand at fancy prices.

The "Steel Red," of the "Baldwin" type, not as prolific, better quality, good tree, profitable. The old "Black Gilleflower" is often called for; one of the best trees, good bearer of very uniform, perfect fruit, good keepers, one of the best shippers, and the best apple for the Southern market. The "Roxbury Russet" is the best of the russets; a good tree, good annual bearer of good sized fruit, one of the best keepers when properly handled. The "Wolf River" is a strong growing, hardy tree; a very large red apple of high quality, keeps until January. The "Arctic" and "Sutton Beauty" are new, handsome red apples of great promise, but not tested fully. The "Jonathan," "Grimes' Golden," "Canada Red," "Pome Griss," "Lawyer," "Limber Ling," "Shockly," "English Russet" and "Jewet's Red," are all too small for profit. The "Tolman Sweet" is the best sweet winter apple, but of late years has been so infested with the railroad worm as to be useless.

There are many fall apples of high quality, but growing them for profit has not been a success.

A HOME MARKET FOR FRUITS.

By A. A. HALLADAY, Mapledell Fruit Farm, Bellows Falls.

I have been very successful in making a home market for my fruits. I use the word "*making*," for the home market does not grow wild to be easily picked by any one. It must be *made*. As I look back over the past, it seems to me a hard thing to say just *how* I have succeeded in making a very excellent home market for my own products. It has been made up of no one particular item but of many, yes, very many little things. It would be quite impossible for me to name all of them.

One thing is certain. The grower must have the full confidence of the consumer, for without this his efforts to secure a home market will be of no avail. When once this confidence is secured, he must then strive by every honorable means in his power to keep it. When I commenced growing fruits for market it was a question with me whether I could secure a home market for all I wanted to grow. I was determined to grow *the best* or none, to grade closely, put them up in clean baskets, give large measure, make each grade as uniform in quality as possible, employ only the best pickers and market every berry the same day it was picked. And knowing that such berries would cost more than the poor trash that came to our market, I was determined to get a correspondingly higher price.

My farm is only one mile from the center of our village, and I have taken much pains to make my place attractive, by growing many flowers, which are free to any one who will come there for them. Perhaps you may think that this has nothing to do with a market for fruits, but I can assure you that it has a very great deal to do with it. Thousands of people come here every season to look about, and while it takes time to show them about (which I always do) they go away pleased and always tell their friends and neighbors about "Halladay's fruits." I invite every one to come and bring along their friends. People come in carriages and on foot. Strangers visiting in town are taken here by their friends "to look around," and we strive to make it as pleasant as possible for all who come. Now many of you may think that all this is of no account, and will do little towards making a home market for fruit, but if you think so you are certainly mistaken, for I know that I can spend a portion of my time to no better ad-

vantage than in showing these people how I grow and handle the fruit that they are to eat. It gives them confidence in me and in my ability to furnish them with good, clean, wholesome fruit, and thus one-half of the battle is won.

I have never "peddled" my small fruits, except the first season, and in that one season by putting up my fruit as I have described I secured all the best customers in town. They soon learned that my berries were *fresh*, *clean*, of uniform quality throughout the basket, and that the baskets were always full, and they were willing to, and did pay me double the price that ordinary berries were selling for. We must keep people talking about us and our fruits as long as they will say good things of us.

For a number of years past our leading market man has handled all my small fruits, he contracts to take all I have, and to show you the price my berries bring, I will state that this past season of 1898, when strawberries were a drug on the markets everywhere, and with nice native berries being sold on our streets at four and six boxes for 25 cents. My berries started off at 25 cents per box and a large part of my crop brought 18, 20 and 25 cents, and a few 15 cents. All my raspberries brought 20 cents per basket. The few seconds of strawberries brought five cents wholesale or as much as many other growers were retailing their best berries for.

Of course my strawberries are all assorted after they are bronght in by the pickers. This work I look after personally, thus I am able to guarantee every box of berries sent out. I "top" every box myself by packing the berries close together with hulls down, which if nicely done, gives the basket a very fine appearance. I am always particular to have the "topping" berries no larger or better in any way than those in the rest of the box. I use the Renitt Patent display crate, which shows up the fruit to the best advantage.

I employ good, clean wholesome pickers. Many of them are sons of our first families. I pay a little more than the regular price, and expect from them better work than is usually done by pickers. At the end of the berry season, all of the pickers who have staid through are invited to a "Strawberry cake" supper. Tables are spread on the lawn, strawberry cakes are made in large pans, made expressly for the purpose. I think you will be able to imagine the rest. I have no trouble in getting good pickers and keeping them. I get enough for my fruit above the regular market price to pay the entire cost of growing it.

What is true of small fruits is also true of the larger sorts. I find just as ready sale for all my fruits as for strawberries. I never have to "peddle." My orders for plums and cherries

are always far in excess of the supply. Perhaps some of you may jump to the conclusion that I have all the fruit grown in this section, but this is not the fact. Our market is over-run with fruit, but it is of that "*shiftless, homesick*" kind so common in all markets. Of course there is a certain class who care nothing for looks, but even these people can be educated up to buy a better article.

One should never forget his own personal appearance, or think that because he is a farmer or gardner that he must go about looking like a tramp. Clothes and shoe blacking are cheap, and the odors from the horse and cow stable add nothing *good* to the flavors of fruit.

I market plums in four and eight quart baskets, and by my practice of pruning and thinning my plums are always number one. And while many of my neighbors complain that they can not find ready sale for their fruit I have never yet been able to fill my orders. However, by planting trees every season I hope to be able some time to supply all demands. All baskets for plums should be supplied with handles so they may be easily carried by merchants and others when going home from their business. Small packages of nicely assorted fruit are very attractive, and will bring more money than larger packages of inferior fruit. If you are so unfortunate as to have a poor lot of fruit, don't put it on the market. It will injure your reputation and bring you but little money. Better give it to people who cannot afford to buy fruit, and then make a special effort to grow better fruit next time.

NEW OR LITTLE KNOWN FRUITS IN VERMONT.

By D. C. Hicks, North Clarendon.

The object of this paper is two-fold. First, to call attention to some old and new varieties of fruits that are quite generally grown in the state; and second, to make brief mention of a few species that are not. Now at the start I wish to say that this is done with some knowledge of the existing conditions that will prevent their general cultivation. But go back a few years and note the condition. At that time in the Memphremagog valley, a region practically without the common orchard fruits, now some of the finest orchards in the State can be seen there; a change brought about by the untiring efforts of one man, and that man, Dr. T. H. Hoskins of Newport. It is without the scope of this paper to even outline the persistent and systematic work that has accomplished this, but it is a record for horticultural history that will be left for the generations to come. Now if we can raise these fruits, even in limited quantities for home use, it will increase our home comforts and at the same time give us a wider range of horticultural knowledge and productions, and in time existing conditions may be so modified or overcome by experimental work with new varieties and improved systems of cultivation, that we may even raise some of these fruits for our local markets. I may hope that the above reasons will be sufficient to warrant me in using the little space that I devote to them in this paper.

APPLES.

Sutton Beauty.—I first became interested in this apple in the spring of 1874, while on a visit to the town of its origin, Sutton, Worcester County, Massachusetts. I visited the original tree, which at that time, I should say, was from thirty-five to forty-five years old. It was growing in an orchard of many old trees, composed almost wholly of Hubbardston, Nonsuch and Baldwin's. The growth characteristics were like Hubbardston, while the fruit in color and shape resembled the Baldwin, but with more character than either. No reliable data could be obtained as to its origin, but it is undoubtedly a seedling of Hubbardston or Baldwin, with the probabilities in

favor of the former. In its home it is a good annual bearer of large, high-colored, winter-keeping fruit. I have two or three top-worked trees of this variety that should fruit next season, and I can then report on its behavior in this section of Vermont. I know of but few varieties that will grow a stronger, better tree in the nursery than this. It is being largely planted in New England and Western New York and with much promise of being a valuable addition to our commercial orchards.

Foundling.—I have fruited this both in the eastern and western sections of the State and find it a valuable apple for home use and market. The tree is a good, strong, grower, and hardy in exposed locations and it is an early and free bearer of large, handsome fruit ; very similar in size, shape and color to Gravenstine and of about the same acidity. This apple was first grown in Orange county, this State, where it was brought from its Massachusetts home (Groton) by Mr. George Nutting, who did much to make the merits of this fruit known in the section about him.

Shiawassie—I am much pleased with this apple. It is larger, later, and handles better than Fameuse, and as yet it is free from the black, scabby spots that often spoil Fameuse and McIntosh.

Scanlet Pippin—Another one of the Fameuse family that come to my notice a few years ago as *Leed's Beauty.* It is a high colored fruit, closely resembling McIntosh in color and shape, but with flesh that is firmer and with more acidity, tree a rapid grower and I think more productive than McIntosh, which is lacking in that respect. Its high color and good quality ought to make this apple a valuable addition to our late fall and early winter kinds.

Stump.—This variety originated many years ago in Monroe County, New York, and has been distributed to some extent under the name of *Red Porter.* It is of the true Porter shape and ripens at same time, but here all resemblance ends. Tree, rapid, upright grower, bearing its fruit on short spurs, its bright red color combined with excellent quality for dessert or cooking, make it a quick seller ; it is also very productive.

Jewell's Fine Red. (Syn. *Nod head.*)—A New Hampshire apple of the finest quality ; season late, autumn into winter ; tree moderate grower and fairly productive and may be classed as an annual bearer ; it requires good cultivation and a sunny location to be at its best ; it will give fruit then that for eating out of hand can hardly be equaled.

Walter Pease.—A Connecticut apple of recent introduction . season from October to January. Tree a very rapid grower and comes into bearing early ; fruit large size, brilliant red in color,

nearly round ; as grown in New York the quality is superb. I shall plant more of this variety for local markets.

Jacob Sweet.—A Massachusetts apple that promises to combine all the good points that should be found in a late keeping sweet apple. Large size, good color and high quality ; tree a slow grower in nursery, but when grafted on mature trees, seedlings or Talman stock, a bearing top is soon secured ; season February to May. There will be a good local demand for a sweet apple of this class. The fruit when ripened is as melting and juicy as early Sweet Bough.

Garden Royal.—An extra early apple of the highest quality, medium size, red striped ; tree a strong, upright grower and an annual bearer. This is a Vermont apple that is without a peer as a dessert fruit, and should be propagated and introduced. Origin, Windham County.

PLUMS.

Passing from the apple to the plum, I will first make brief mention of *Monarch*, a recently introduced English plum, originating with T. Rivers & Son. It is large, late and handsome and in quality rather better than Lombard. It has no fault in growth of tree and hardiness of wood and fruit buds.

Spaulding.—A very early ripening variety, almost as early as Abundance. The fruit is large, color yellowish-green, with white bloom ; flesh juicy and very sweet, nearly a freestone, growth of tree similar to Monarch. While it does not carry out the claims of its introducers as to entire freedom from the attack of the "little funk," it has so far been entirely free from the brown rot, one of the worst foes to plum culture.

Giant Prune, Tennant Prune and Pacific Prune are new varieties and have not fruited with me yet. The first two are strong growers and seem perfectly hardy. The Pacific is somewhat tender. We had fruit of the Giant Prune at Rutland County Fair last fall in a collection from Washington County, New York. In size these specimens were somewhat larger than Pond's Seedling, and the quality rich and sweet, as expected in so large a plum. The texture of flesh was a little coarse ; it is late in ripening, about October 1st Tennant prune, as grown by the same party, is earlier in ripening ; flesh fine grained, color dark purple with blue bloom, and quality excellent ; comes into bearing early.

PEARS.

Vermont Beauty.—This pear is now quite well known in New England and the Middle States, and as far as I know it

has everywhere carried out the claims of the introducers for rapid and strong growth both in the nursery and orchard. Its hardiness is unquestioned, and the fruit, while only medium in size, is of fine color and good quality—one of the best pears of its season.

Grand Isle.—Similar in growth of tree to Flemish Beauty; fruit nearly as large as that well known variety, color of fruit yellow with faint blush on sunny side, ripens last of September; not as good in quality as Vermont Beauty. Both of these pears originated on Grand Isle and are valuable additions to our list of hardy pears.

Eastern Belle.—This hardy pear comes to us from Bangor, Maine, and is one of the creations of that well known pomologist, Henry McLaughlin. It has been in fruiting several years and has proved hardy and productive; it is a seedling of Belle Lucnative and in fruit resembles that fine old variety. Grafted upon a Kieffen it bore me fruit the third season. I shall plant more of this variety.

I would mention for very early, Doynned, etc., Giffard and Wilder, only for home use; they are too small for market. The first named is the smallest, earliest and best in quality, all reasonably hardy and thrifty growers.

CHERRIES.

Two cherries that I am well pleased with are *Dyehouse* and *Olivet.* The former is a few days earlier than Richmond, lighter red and slightly smaller fruit, pit small, and in quality as good as Richmond. The tree is a rapid grower, the branches having a pendulous habit; it is an early and regular bearer and fruit sells well in local market. Olivet is an abundant bearer of large, deep red fruit, quality rich, vinous, mild acid. This cherry is a third larger than Richmond or Morrello, and ripens a week or ten days later than Richmond. The best sour cherry on my grounds.

GRAPES.

In this class of fruits I will name only one under each color, black, red and white. Two of these are varieties that have been before the public for several years; the other a seedling not yet for sale. The one selected under first color, is Nectar, or Black Delaware, a cross between Delaware and Concord, and combining the good qualities of both to a remarkable degree; equal in quality to Delaware, ripens earlier, a little larger in size, full shouldered bunches, which will hang a long time on the vine without losing in quality; when once es-

tablished, a thrifty grower, hardy and productive a fine grape for home use.

Wyoming.—In this grape we have a hardy, healthy, robust vine, with thick leathery foliage, very free from mildew; in color the fruit is of the brightest amber, a third larger than Delaware, and a week earlier than that well known variety; quality is of the best. Several years ago I planted out a vine of this variety and it has proved more satisfactory than Brighton or Vergennes.

Woodbury.—(Niagara Seedling.) Originated in Oxford county, Maine, with David B. Woodbury. In vine this new grape is even more healthy and vigorous than its parent. My oldest vine has now fruited two seasons and has had no winter protection. Fruit is large and bunches heavily shouldered, skin thick and tough and it is an extra keeper, seeds few and part readily from pulp which is juicy and sweet, ripens with Moore's Early. Unless later it should develop some weak points, it is a more desirable white grape than Niagara.

OTHER FRUITS.

Now in taking up the fruits but little known in the state, I will first mention the Quince. This fruit has been grown in the past in several localities, with varying success. The past season a friend in Windsor County reports a good crop of this fruit, variety Champion. This party, who has had experience covering a period of years, recommends this as the only variety that has succeeded with him, Orange, Rea and Meech failing to fruit satisfactorily. The experience of those who have succeeded with this fruit seems to show that while the wood growth is hardy, the roots are tender, especially so until well established. A heavy mulch will partially overcome this; well drained soil and good cultivation are necessary; with these there are many locations where this fruit will succeed. I would recommend the following varieties for trial, as some of them may be found better suited to withstand our climate than the older varieties: Alask, Missouri Prolific, Bourgeat and possibly Childs.

The Peach.—This fruit is one that is almost as universally grown as the apple, and our own markets are supplied with it for a long season; new sections that are suited to the cultivation of this fruit are being opened up rapidly, and by the introduction of new and hardy varieties, the borders of the older sections are gradually being extended; the fruiting belt of this fruit in the states of Massachusetts, Connecticut and New Hampshire is steadily being pushed north and west, and is now within a hundred miles of our eastern and southern border; this is due not to

changed climatic conditions, but to the selection of better locations for planting, use of varieties tested for hardiness, and a better knowledge of the care and cultivation necessary to success. As long ago as 1860 in the Connecticut River valley, a good crop of this fruit was ripened on some seedling trees that were grown from pits, brought from Massachusetts some years before, and last year (1898) a party in an adjoining town raised a crop of one half bushel to the tree on several trees of the Crosby and the fruit compared well with that in the local markets. Other instances might be quoted, but this is sufficient to show what has been done; there are many places in the warmer valleys of the state, where with proper selection of varieties, this fruit can be grown. Without discussing methods and varieties, we should expect the most success with seedling trees, raised from well ripened pits and at proper age those that showed the most vitality could be budded to the hardiest named varieties; and I will mention as promising in this direction, Crosby, Bokana No. 3 and Holdenbaum.

I will now devote a little space to that fine culinary fruit, the cranberry. Thirty years ago its production was confined to limited areas in three or four of our seaboard states. Now large sections are devoted to its culture in several of our northern states, Ontario and the maritime provinces of Canada; while smaller ones may be found in several other states, and with these Vermont, and here where intelligent work has been done in preparing the land and in furnishing facilities for flooding in time of need, good results have been obtained. Now we have many acres of marsh land that in its present state is worthless, that might be converted into profitable bogs. The first cost of fitting and planting an acre would be greater than for almost any other crop, but the permanent character of the work would compensate for this, coupled with the fact that there would always be a home market for all the fruit raised. Our natural conditions are not adverse to the growing of this fruit, as the few trials already made have amply proved.

Now to close, I will bring to your notice a fruit that is native to the state, but one whose value as a dessert and culinary fruit our people have been slow to appreciate, the gooseberry. Its uses are many, and the difficulties of cultivation and protection from insect foes are not more serious than for the currant, and like this last named fruit, good cultivation and proper pruning and thinning of fruit is very necessary for best results; the varieties I have tested are Houghton, Smith, Downing and Industry. The latter is an English variety of excellent quality, but subject to mildew. In making small plantings of this fruit for home use, we might expect the best results from the following American seedlings: Red Jacket, Pearl, Triumph

and Chatauqua. The first of these has been tested in a few localities in the state and not found wanting in hardiness, productiveness and good quality. Single bushes of this variety have produced ten to twelve quarts. Before large plantings of this fruit could be made profitable, a market demand would have to be made for it in our cities and villages, where at present it is so little known.

REPORT OF THE BOARD OF AGRICULTURE AS CATTLE COMMISSIONERS.

FROM JULY 1, 1898, TO JULY 1, 1899.

IN THE WORK OF THE CATTLE COMMISSION SINCE DECEMBER 1, 1898,

The rules of the previous Board have been generally followed. The Commission work was directed by V. I. Spear, Secretary, until December 1st, 1898. Upon the organization of the present Board the supervision of the work was placed in charge of the present secretary, assisted by J. K. Curtis in the First Congressional District. The tables on pages 148-150 will show the results of the work accomplished.

But little re-testing has been done since December 1st. What has been done shows the careful work of previous Commissioners. In the retest, in February, of the herd belonging to F. M. Snow of East Montpelier (fifteen having been slaughtered after the first test in October) five were killed and found diseased. These cases were deemed suspicious on the first test.

The preseut Commission has attended to more requests for testing small herds, where the owners were suspicious of disease, than has been the custom with previous Commissions. This adds considerably to the expense, yet it is thought necessary in order to check the disease.

Since December 1st, close attention has been given to the importation of cattle. One hundred and eight permits have been granted, admitting 1,537 head of cattle. A tuberculin test has been required in all cases excepting with calves under ten months of age, and care has been taken that these have come from healthy herds. Butchers living near the State line have been permitted upon application to bring in beef cattle for immediate slaughter.

Some buyers of cattle have been slow to understand that the law required a permit from the Commission before cattle could be brought into the State. Parties ignoring this law have been called upon to pay a small fine for such neglect and these fines have been turned in to the State Treasury.

Many of the cattle coming into the state by permit have been allowed to enter and be tested upon their arrival at the premises of the owner with the understanding that if any responded to the test they must be returned to the place from whence they came. This has been allowed, in the belief that a more satisfactory test could be secured by employing Vermont veterinarians than those outside the state.

Cattle come in to pasture more or less every season from all borders of the State except the northern boundary. Forty-six pasture permits have been granted, admitting about 1400 head for the season. No test has been required for these except for some coming from the stockyards in Massachusetts. A careful description of every lot is required, giving the number of head, breed, color, age, owner's name, name of the town where the pasture is located and the owner thereof, and also a promise that they shall not be kept in pasture with state cattle. Exception has been made where a party is owner of land on each side of state line, in which case permission has been given the owner to drive his own cattle back and forth at will.

THE TUBERCULIN TEST FOR TUBERCULOSIS.

Some cattle owners doubt the value of tuberculin as a means of pointing out the disease, while many others try to think it injures the animal. For this reason, the following excerpt is made from the year book of the Department of Agriculture.

THE PREPARATION AND USE OF TUBERCULIN.

By E. A. de Schweinitz, Ph. D., M. D., Chief of Biochemic Division, Bureau of Animal Industry.

INTRODUCTION.

Tuberculin is a solution in glycerine and water of the products of the growth of the tubercle bacilli upon artificial media and the contents of their cells. Although it has been manufactured in quantity and used upon a large scale for some years, it may at the present time be of interest to give a brief sketch of the methods of manufacture of this material as followed in the Biochemic Division, and to note the advantages or objections to its use as a diagnostic agent for tuberculosis in animals and men.

METHOD OF PREPARING TUBERCULIN.

In the preparation of large quantities of tuberculin in the biochemic laboratory of the Bureau of Animal Industry during past years, the following method of procedure has been found to give the most satisfactory results: The fluid upon which the tubercle bacilli are allowed to grow is an extract made with distilled water from perfectly fresh meat which has been finely chopped. One pound of meat is used to a liter of water, to which is added 1 per cent. of peptone, one-fourth of 1 per cent. of salt, and 7 per cent glycerin. The solution is heated to boiling, filtered, and placed in perfectly sterilized flasks. The medium is then sterilized for three successive days in a steam bath. After the cotton plugs of the flasks have become dry, they are removed, dipped in paraffin, and replaced in the flasks so as to make tight stoppers. When the culture medium so prepared is found to be thoroughly sterile, it is inoculated. The thorough sterilization of the media can be proved by allowing the flask to stand for some days in a warm place, during which time they should remain perfectly clear if there is no contamination with ordinary bacteria from the air.

INOCULATING THE MEDIA.

The inoculation of the media in the flasks is accomplished by taking up on the end of a platinum wire a small mass of tubercle bacilli obtained originally from an animal that has died of tuberculosis. The first cultures are made from dead animals, by transferring to a jelly made of glycerin and agar, or blood serum, or potato, pieces of the diseased organ, lung or spleen, of a guinea pig that has been infected by inoculation with tuberculosis. The germs, after four to six weeks, are found to have developed very readily, and to form a thick, spongy layer on the surface of the jelly or potato. It is a very easy matter to detach a small bit of this spongy growth from the surface of the jelly and transfer it to the flask containing the liquid media prepared in the manner already indicated.

In order that the tubercle bacilli may grow readily, it is necessary that they shall have a free supply of oxygen; hence, the mass of bacteria that are transferred to the flask should be caused to float on the surface of the liquid. This can be readily accomplished by detaching a piece of the culture mass from the platinum needle and floating it upon the surface of the liquid without immersing it. If the inoculating piece is allowed to become wet with the culture media, it will sink to the bottom of the flask and the bacteria will not develop. The inoculated flasks are then placed in the incubator, which is a double-walled copper box. The space between the copper walls of the

incubator is filled with water. The incubator is kept at a constant temperature of about 98° F. After a week to ten days the tubercle bacilli will be seen spreading out in all directions from the particle with which the flask was inoculated, and finally the surface of the liquid will be covered with a layer of tubercle bacilli. When this is noted, the flask should be carefully shaken, so as to cause most of the growth upon the surface to be immersed in the culture liquid and to sink to the bottom of the flask. A small particle, however, should be left on the surface to serve as seed for a new surface growth. This shaking down of the surface growth can be readily accomplished by rotating the flask two or three times very gently, and after a little practice it will be found to be an easy matter to preserve the desired particle upon the surface. From this particle a new surface growth is developed, which should be shaken down as in the first instance, and a third growth allowed to form. This process will require six weeks to two months or more from the time that the flasks were first inoculated, and their contents are then in a condition to be further used for the preparation of tuberculin.

When first obtained from the animal body, the tubercle bacillus grows best upon blood serum, or potato, or a liquid, such as has been already indicated, that has a faint alkaline reaction to litmus or is perfectly neutral. After a time, however, when the tubercle germ has become accustomed to its new food, just as a plant must adapt itself to a new soil, it can be caused to grow upon medium that has a slight acid reaction. When liquid cultures of the tubercle bacilli have been once inoculated and are growing well, it is very much easier to inoculate fresh culture media from liquid cultures rather than from the jelly cultures, with which it is always necessary to start. The transference of a particle containing large numbers of the germs from the surface of one flask to serve as seed upon the surface of another flask will give what is commonly called a new generation. As these transfers are usually made every month or six weeks, it is possible in the course of a few years, to obtain a germ which is a direct descendant of the one original used, but removed from it by many generations. This continued transference of the bacteria from one nutrient flask to another has the effect in many cases of changing some of the properties of the germ. In the laboratory of the Biochemic Division it has been found, in connection with the tubercle germ, that this fact can be utilized to great advantage. There are in the laboratory now, and have been for a number of years, the descendants of a tubercle germ which originally caused the death of guinea pigs in from four to five weeks after they had been inoculated. This germ, which is now per-

fectly harmless, was originally obtained from a specimen of tuberculous sputum. The guinea pigs inoculated with this sputum died in due time from tuberculosis, and the cultures made from the diseased organs served as a starting point for a large and prolific family. By accustoming this germ gradually to liquid food which had a slight acid reaction, we eventually succeeded in elminating its ability to produce tuberculosis when it was inoculated into animals. The germs, however, did not lose the property of producing or secreting their active poisons—those poisons which form the active principle of tuberculin. Cultures of this sort, which have been caused to lose their virulence or pathogenic properties, are called attenuated, and we have used these attenuated cultures to great advantage since 1893, both in preparing tuberculin and in treating animals, or injecting animals for the purpose of protecting them against an inoculation with virulent tuberculosis or producing in them a serum which may have curative properties. Virulent cultures are also used in preparing the tuberculin, and there are always a number of different generations of varying virulence of tubercle bacilli on hand in the laboratory.

STERILIZING THE CULTURES.

When the tubercle cultures have grown sufficiently, which requires from one month to three months, depending upon the readiness with which the growth begins (and this is always influenced by the reaction of the media and the condition of the culture from which the inoculations are made), the flasks with their contents are removed from the incubator and placed immediately in the sterilizing oven, which is kept at a temperature of about 125° C. The cultures are left in this oven until they begin to boil. In this way the germs are killed, and the plugs in the mouth of the flasks may be removed and the material filtered without any danger of infecting the workers. Of course, in handling tubercle cultures in such large quantities there is always some danger of infection for the people who are doing the work. When proper care is used this danger is of practically no importance; but as accidents may occur (flasks be broken and their contents spilled upon tables or floor or in other places), it is a matter of impossibility to avoid all danger. But the discovery that the attenuated germs can be used to advantage for the preparation of tuberculin materially reduces the possibility of danger to the workers in handling this material. After heating the flasks in the sterilizer the cotton plugs are removed and the contents of the flask heated over a flame to boiling and immediately filtered. The germs, which are packed close together, remain upon the filter paper and are

washed once or twice with a small amount of water. The filtrate, including the washings, is then evaporated, and may be concentrated to any desired volume. As a rule, one-fifth of the quantity of the original culture is the most convenient point to be reached in the evaporation. Instead of filtering off the germs and then evaporating the filtrate, the entire contents of the flask may be concentrated by evaporation and the solution filtered after it has been concentrated. The results are the same but the writer's preference is for the first method.

DILUTION OF TUBERCULIN.

Instead of sending out concentrated tuberculin, it has been found advisable to dilute it to such a strength that 2 cubic centimeters will be a suitable dose for the purpose of diagnosing tuberculosis in cattle. To accomplish this dilution, there is added to the concentrated tuberculin glycerin equal to one-fourth the original bulk of the cultured liquid. This is then diluted with one-fourth of 1 per cent. carbolic acid, so that the volume of the tuberculin usually obtained is one-fourth more than the original quantity of culture media used. In other words, 1,000 cubic centimeters of culture media, after the germ has been allowed to grow sufficiently long, diluted with the proper amount of glycerin and carbolic acid, should give 1,250 cubic centimeters of tuberculin of such a strength that 2 cubic centimeters would be a satisfactory dose for testing an animal of 1,000 pounds in weight.

METHODS OF STANDARDIZING TUBERCULIN.

Several methods of standardization of the tuberculin are adopted. The amount of the tuberculin required to produce a rise of 4° or 5° in temperature in tuberculous guinea pigs of 1 pound in weight is noted, or the quantity of tuberculin found necessary to kill a tuberculous guinea pig; or, again, a standard upon a chemical basis, depending upon the amount of acid which is produced by the growth of the bacilli, if used. All tubercle cultures after they are well grown show a decided acid reaction. If the reaction of the media is carefully noted before inoculation, and again after the growth of the germ, it is found that the amount of acid reaction is increased proportionately to the quantity of the growth. By practice, it is also found that this is approximately constant. If the value of a tuberculin made from a culture in which the acid reaction has been carefully tested is once noted it serves as a guide for future work.

In practice, it has been found that healthy animals do not give reactions with large doses of tuberculin, and that as a rule

tuberculous animals do not show an appreciably higher reaction with large doses of tuberculin than with medium doses; hence, while the above methods of standardization are not so accurate as those which would have to be used in weighing out a very poisonous alkaloid, experience has shown that they are sufficiently accurate for ordinary work.

If the tuberculin is intended for use upon man, it should, in addition to the filtration through a fine filter paper, be filtered through porous porcelain, so as to remove the last possible germ. In the preparation of tuberculin, however, for use upon animals, especially when attenuated cultures are used as the source for the material, this filtration through porcelain is not necessary.

LOSS IN PREPARING AND COST OF TUBERCULIN.

In handling large amounts of culture media for the preparation of tuberculin there is always a certain amount of unavoidable loss. Sometimes in the process of inoculation, even with the utmost care, the flasks will become contaminated by some foreign germ. Sometimes the contamination may not take place until the culture is pretty well grown. Then it is often due to an imperfect plug or unavoidable handling of the culture. The quantity of cultures lost depends, of course, upon the care of the individual in handling them, the care in inoculation, and the locality in which this work is conducted. All inoculations of tubercle flasks, as well as other culture media, should be made in an air that is free from dust, and consequently free from dangers of contamination. When proper care is used, possibly one-fourth of 1 per cent. of the flasks are lost, but the writer has found that in the hands of inexperienced individuals 20, 30, and even 50 per cent. of culture flasks may be contaminated. Frequently, as in the case of tubercle cultures, this contamination can be very readily detected. So long as the cultures are pure the germs will be found floating upon the surface of the liquid or at the bottom of the flask, while the rest of the media will be perfectly clear. The slightest contamination causes the media to become cloudy; and as soon as this is noted the flasks should be discarded, as tuberculin should be prepared only from perfectly pure cultures. In experienced hands the cost of the preparation of tuberculin is not great. It should be made and sold, giving a fair profit for the trouble connected with its manufacture, at not over five cents a dose.

THE METHOD OF USING TUBERCULIN.

The regulations prescribed for many years by the Bureau of Animal Industry for the use of tuberculin in testing cattle are as follows:

DIRECTIONS FOR USING TUBERCULIN AS PREPARED IN THE BIOCHEMIC LABORATORY OF THE BUREAU OF ANIMAL INDUSTRY FOR THE DIAGNOSIS OF TUBERCULOSIS IN CATTLE.

The febrile reaction in tuberculous cattle following the subcutaneous injection of tuberculin begins from six to ten hours after the injection, reaches the maximum nine to fifteen hours after the injection, and returns to normal eighteen to twenty-six hour after the injection.

In conducting the test the following course is recommended to those who wish to obtain the most accurate results:

(1) Begin to take the rectal temperature at 6 a. m., and take it every hour thereafter until midnight.

(2) Make the injection at midnight.

(3 Begin to take the temperature next morning at 6 o'clock, and continue as on preceding day.

To those who have large herds to examine or who are unable to give the time required by the above directions, the following shortened course is recommended:

(1) Begin to take the temperature at 8 a. m., and continue every two hours until 10 p. m. (omitting at 8 p. m. if more convenient).

(2) Make the injection at 10 p. m.

(3) Take the temperature next morning at 6 or 8 o'clock, and every two hours thereafter until 6 or 8 p. m.

Each adult animal should receive 2 cubic centimeters (about 30 minims) of the undiluted tuberculin as it is sent from the laboratory. Yearlings and two-year-olds should receive 1 to 1½ cubic centimeters, according to size. Bulls and very large animals may receive 3 cubic centimeters. The injection is made beneath the skin of the neck or shoulders.

There is usually no marked local swelling at the seat of injection.

There is, now and then, uneasiness, trembling, and the more frequent passage of softened dung. There may also be a slight acceleration of the pulse and of the breathing.

A rise in the temperature on the day following the injection of two or more degrees F. above the maximum observed on the previous day, should be regarded as an indication of tuberculosis. For any rise less than this a repetition of the injection after three to six weeks is highly desirable.

In rare cases the temperature may rise in the absence of any disease, or it may fail to rise when tuberculosis is present.

It is hardly necessary to suggest that, for the convenience of the one making the test, the animals should not be turned out, but fed and watered in the stable. It is desirable to make note of the time of feeding and watering.

Charts for reporting to the Bureau of Animal Industry results of tests are always forwarded with the material. It is not necessary that the temperature should be taken at the exact hour indicated upon these charts, but the hours selected have been considered the most convenient for the test. If the animal is diseased, from six to eight hours after the injection of the tuberculin the temperature begins to rise from the normal, which in cattle varies from 101° to 102° F., and should continue to rise until it has reached 105° to 107°. A reaction of 2° F. above the normal may be considered as good evidence that the animal is infected with tuberculosis.

When tuberculin is to be used upon dairy cattle, a test of the same herd should be made at least once every six months. Dairy cows should be carefully tested by means of tuberculin, and this is required at present by some of the States. Dairy herds once found free from disease should not be subjected to the danger of infection by the introduction of new animals that have not been previously tested and found perfectly sound. The health of animals and of men is very largely dependent upon the use of sanitary precautions and the enforcement of sanitary regulations, such as can be adopted by the aid of a definite diagnostic material like tuberculin.

ABSENCE OF DANGER IN THE USE OF TUBERCULIN.

As will readily be seen from the manner of preparation described, there is not the slightest possible danger of infecting animals or men with tuberculosis from the use of tuberculin. The cultures are heated several times to a temperature a great deal above that necessary to kill the tubercle bacillus, and, in addition, the tuberculin is diluted with carbolic acid, which is an excellent disinfectant and germicide. Again, there is no danger of injuring healthy animals even with quite large doses of tuberculin, as the tuberculin is apparently very readily eliminated in the feces and urine.

When tuberculin is to be used for diagnosing disease in man, very much smaller doses are necessary than in the case of animals. From 1 to 3 milligrams are found sufficient in most cases.

The method of injecting tuberculin upon man for diagnosis, as prescribed by Dr. Trudeau, one who has had a great deal of experience in its use, is as follows:

"In applying the tuberculin test, I take the temperature for several days beforehand, at 8 A. M., 3 P. M. and 8 P. M. For the first injection, I usually take 1 milligram of Koch's original tuberculin [5 milligrams Bureau tuberculin], injected as late as possible at bedtime; then note the temperature every two hours

the next day. If no reaction follows, after an interval of two days I usually inject 3 milligrams [15 milligrams Bureau tuberculin]. In suspected visceral tuberculosis I usually stop here, but if it is a surgical tuberculosis, where the amount of disease may be very slight, it is well, perhaps, to try another dose of 5 or 6 milligrams after another interval. The reaction usually begins from eight to twelve hours after the injection.

THE DIAGNOSTIC VALUE OF TUBERCULIN.

One of the objections that has often been brought forward against the use of tuberculin upon cattle is that it is entirely too delicate; that by its aid disease is detected in animals which might not have been dangerous for many years. It is, however, utterly impossible to tell how soon a very slight case of tuberculosis may develop into a very dangerous one, and during this time the animal is the best possible source of infection for other animals. The contagiousness of tuberculosis both among animals and men is well established, and this being known, animals which are found infected with tuberculosis in the slightest degree should either be slaughtered and the healthy portion of the animal used as food, if thoroughly cooked, or better still such animals may be isolated and quarantined and used for breeding purposes, and the calves isolated and fed upon sterilized milk. By adopting a method of this sort, which is both economical and practical, the objection so often made that tuberculin does not give an indication of the character of disease is easily dispensed with. The moment that the disease is found present, that moment the individual becomes dangerous to the rest of the cattle in the herd, and the necessary precautions should be taken.

In Denmark and in several places in this country the method of isolating animals infected with tuberculosis and using them for breeding purposes has been pursued with excellent results, and there is no reason why the same thing may not be done generally in this country. In some localities this method could not be carried out satisfactorily, and then, of course, it becomes necessary to destroy the animals that are infected with tuberculosis. Occasionally this may be a hardship for the owner of the animal, unless the city or State is willing to pay for the animal a price which would, at any rate, partially reimburse him for his loss. It is quite as legitimate for this to be done as for the adoption of any other sanitary regulations which are of importance for the health of the community.

It occasionally happens that animals badly diseased or in an excited condition from various causes have a high temperature at the time of injection and will not give a satisfactory reaction to tuberculin. In these cases, however, the disease is usually so far

advanced that it can be detected very readily upon physical examination. These exceptions can not be used as objections to the utility of tuberculin, and do not depreciate its value in the slightest degree. It also occasionally happens that some animals but slightly affected with disease will not react, or animals which upon post-mortem appear perfectly healthy have shown reaction. The eminent veterinarian Nocard and others, however, claim that, in all cases in which very careful post-mortem examinations have been made upon animals which had reacted to the tuberculin test but did not show marked post-mortem lesions, they have demonstrated that the germ of the disease was present in the system and had just begun its development. To prove this the most careful bacteriological examination and inoculation tests are necessary. The tuberculin test, it is true, is not infallible, but the mistakes that may occur from its use are so few and it is so much more nearly perfect than any other method that we have at hand that for practical purposes it may be considered sure. While it may be many years before tuberculosis can be practically eradicated from herds, and while it would require many stringent State and national regulations to succeed in stamping it out, nevertheless by the use of tuberculin and proper methods of disinfection of stables and other localities which have been infected by diseased animal, it will be possible in a comparatively short time to greatly reduce the number of cases of this disease. Dr. Pearson's report to the Pennsylvania board of health indicates a reduction of 33 per cent. in cases of tuberculosis in that State.

As tuberculosis in animals is reduced so will the disease in man be proportionately decreased. There is every evidence to prove conclusively that man may be infected with tuberculosis by drinking the milk from tuberculous animals. Recent work, combined with many experiments that have been conducted in past years, has shown that the tubercle germ of human origin or the tubercle germ of animal origin can adapt itself very readily to its surroundings and grow upon different varieties of media and at different temperatures without its pathogenic or disease-producing properties being destroyed.

It was claimed for a long time that the human tubercle bacillus was not pathogenic for birds. Very recently, however, Nocard has shown that if a culture of the human bacillus be placed in a collodion sack and this sack introduced into the peritoneal cavity of a chicken, after four weeks or more the germ will have assumed the appearance of the avian bacillus and will have become pathogenic for chickens. Again, the tubercle germ has been recently isolated from carp. It was demonstrated very conclusively that these carp were infected from the sputum of a badly tuberculous individual, which spu-

tum was thrown regularly into the pond occupied by the carp. The germ isolated from the carp grew at a very much lower temperature than the human germ, but its origin was undoubtedly human. All this work has proven very conclusively that the tubercle bacillus found in different animals may adapt itself very readily to different surroundings, may be accustomed to grow at lower or higher temperatures, and may eventually grow under conditions that would have been originally entirely destructive to it. This latter point has been very practically demonstrated in this laboratory, the experiments showing that the tubercle bacillus can be gradually accustomed to a nutrient liquid containing glycerin, sodium and potassium phosphate, and ammonium phosphate. When obtained directly from the animal the germ will not grow on this solution, but by cultivating it first upon a medium which more nearly produces the conditions that the germ finds in the animal body it can then be transferred to the solution of mineral salts and caused to grow rapidly and in great abundance. If such conditions can be produced artificially outside of the body there is certainly every reason to believe that the germ can very readily adapt itself to changes in temperature and nutrient conditions that are found in the bodies of different animals and still cause tuberculosis.

During the seven years that tuberculin has been prepared in this laboratory for distribution by the Bureau of Animal Industry to various State officials and experiment stations, the results have been very generally satisfactory. Thousands of reports have been received, from nearly every State in the Union, from Canada and the West Indies, and from many different sources, and with one or two exceptions (exceptions arising very probably from the fact that the users of the material were not experienced in handling it) all have realized the importance and usefulness of tuberculin.

There have been one or two cases in which it was claimed that the tuberculin gave misleading results. One may be noted especially. A supply of tuberculin had been sent from this laboratory in the spring of the year to a certain State veterinarian who distributed it to some of his assistants. One of these assistants kept the bottles standing in his office for several months in the hot sun. He then used some of their contents to test an animal, which, according to report, passed the test and was sold. Subsequently, with another lot of tuberculin, the animal showed the tuberculin reaction, which diagnosis was proved upon post-mortem examination. The doctor to whom this tuberculin had been sent was requested to forward the bottle from which the material had been used to this laboratory. He said that he could not get this, but sent another bottle from the same lot which had not been opened but kept under the

same conditions. This latter bottle was kept for some six or eight months, until an opportunity occurred to have the veterinarian of the District of Columbia use some of it. He was told that it was old tuberculin, and that nothing was known about its reliability, but that he could use it upon animals which showed signs of tuberculosis. This he did, and reported a very characteristic reaction. The writer feels sure that the failure reported in the first instance was due to a personal error and not to the tuberculin.

Contrary to the generally accepted statement, the diluted bottled tuberculin has often been kept in this laboratory for two or three years or more without losing its active properties. In order, however, to avoid all trouble, the usual recommendation is that the tuberculin sent out shall not be used more than six weeks after the date upon the bottle, which indicates the time when it was diluted in the laboratory. This may be an unnecessary precaution, but one which seems advisable when the material is placed with such a large number of people.

CONCLUSIONS.

In conclusion, it would seem that the preparation of tuberculin should always be conducted under experienced direction. It should be distributed through some central authority, so that the results from its use can be collected and tabulated and serve as a source of general information. It is an invaluable test, and by its use, as has been demonstrated by several of the States, especially Vermont, it is certainly possible to reduce very materially tuberculosis among cattle, and it may be possible to eventually exterminate it.

BLACK LEG.

The attention of the Commission has not been called to other diseases among cattle with the exception of one herd in which suspicions of black leg are awaiting test, which will be attended to as soon as the vaccine arrives from the Department at Washington.

GLANDERS.

Several horses have been tested with mallein and two found diseased.

In one case complaint came from the Selectmen of the town that diseased horses were moving upon their highways. At their request a veterinarian was sent with the necessary supplies furnished by the Bureau of Animal Industry to test the cases.

Upon the arrival in town of the veterinarian, neither the horses nor their owners could be found, even with the assistance of the selectmen.

EXPENSES OF THE BOARD OF AGRICULTURE

From July 1st, 1898, to July 1st, 1899.

V. I. Spear, Secretary, to December 1, 1898.		
Services	$300 00	
Expenses	81 00	
		$381 00
F. C. Williams, Asst. Secretary, to December 1, 1898.		
Services		63 50
J. L. Hills.		
Services	$168 00	
Expenses	225 00	
		393 00
A. Messer, to December 1, 1898.		
Services	$12 00	
Expenses	28 50	
		40 50
J. K. Curtis.		
Services	$212 00	
Expenses	145 01	
		357 01
C. J. Bell.		
Services and Assistant	$361 00	
Expenses	300 43	
		661 43
Col. J. H. Brigham.		
Services and expenses		55 54
George W. Perry.		
Services and expenses		20 00
E. S. Brigham.		
Services	$16 00	
Expenses	12 75	
		28 75
G. S. Fassett.		
Services	$8 00	
Expenses	3 75	
		11 75
J. P. Hall.		
Services	$20 00	
Expenses	18 00	
		38 00
Ernest Hitchcock.		
Services	$52 00	
Expenses	26 85	
		78 85
John E. Gale.		
Services	$20 00	
Expenses	14 12	
		34 12

T. L. Kinney.		
Services	$16 00	
Expenses	10 40	
		$26 40
O. J. Lowery.		
Services	$30 00	
Expenses	18 03	
		48 03
D. H. Morse.		
Services	$106 00	
Expenses	69 76	
		175 76
G. H. Perkins		
Services	$4 00	
Expenses	3 54	
		7 54
Cassius Peck.		
Services	$8 00	
Expenses	6 25	
		14 25
F. A. Rich.		
Services	$24 00	
Expenses	12 61	
		36 61
C. F. Smith.		
Services	$56 00	
Expenses	30 23	
		86 23
George H. Terrill.		
Services	$28 00	
Expenses	27 21	
		55 21
J. W. Votey.		
Services	$52 00	
Expenses	32 92	
		84 92
R. W. Whitney.		
Services	$12 00	
Expenses	7 00	
		19 00

MISCELLANEOUS EXPENSES.

The Caledonian Company, printing	$50 25	
The Free Press Association, printing, express and freight	21 05	
		71 30
Total expenditures		$2,788 70

C. J. BELL, Secretary.

EXPENSES OF CATTLE COMMISSIONERS.

MEMBERS OF BOARD.

V. I. Spear, Secretary to December 1st, 1898.		
Services	$318 00	
Assistant	95 00	
Expenses	90 77	
		$503 77
F. C. Williams.		
Services	$19 00	
Expenses	4 61	
		$23 61
J. H. Ware.		
Services	$74 00	
Expenses	60 00	
		$134 00
J. L. Hills.		
Services	$8 00	
		$8 00
J. K. Curtis.		
Services	$90 00	
Expenses	54 62	
		$144 62
C. J. Bell, Secretary from December 1st, 1898.		
Services and Assistant	$289 50	
Expenses	$236 75	$525 25
Total expense of Members of Board		$1,340 25

VETERINARIANS.

A. W. Gorham.		
Services	$15 00	
		$15 00
A. B. Gay.		
Services	$77 00	
Expenses	3 00	
		$80 00
E. W. Culley.		
Services	$286 00	
Expenses	19 43	
		$305 43
J. S. Dutton.		
Services	$87 00	
Expenses	25 21	
		$112 21
L. C. Wakefield.		
Services	$35 00	
Expenses	4 00	
		$39 00

John Thomas.		
Services	$158 00	
Expenses	8 25	
		$166 25
S. W. Ward.		
Services	$219 92	
Expenses	41 15	
		$261 07
George Stephens.		
Services	$115 00	
Expenses	11 76	
		$126 76
Miller and Miller.		
Services	$16 00	
Expenses	5 25	
		$21 25
H. Buss.		
Services	$117 50	
Expenses	9 00	
		$126 50
B. M. Flint.		
Services	$14 00	
		$14 00
W. L. Adams.		
Services	$30 00	
Expenses	5 14	
		$35 14
H. W. Burgess.		
Services	$15 00	
		$15 00
Hermon Philipson.		
Services	$10 00	
Expenses	3 44	
		$13 44
C. A. Prouty.		
Services	$5 00	
		$5 00
Robert Weir.		
Services	$13 00	
Expenses	6 25	
		$19 25
Richard Fisher.		
Services	$268 00	
Expenses	63 28	
		$331 28
Total expense of Veterinarians		$1,686 58

SUMMARY OF WORK OF THE BOARD.

WORK IN CHARGE OF V. I. SPEAR, FROM JULY 1, 1898 TO DECEMBER 1, 1898.

Tested in herds	2,758	
Tested for drovers	1,158	
Total cattle tested		3,916

Number of cattle killed from herds	103	
Number of cattle killed for drovers	4	
Total cattle killed		107
Paid for cattle killed in herds	$1,588 00	
Paid for cattle killed for drovers	70 00	
Total paid for cattle		$1,658 00

WORK IN CHARGE OF C. J. BELL, FROM DECEMBER 1, 1898, TO JULY 1, 1899.

Tested in herds	2,420	
Tested for drovers	1,487	
Total cattle tested		3,907
Number of cattle killed from herds	81	
Number of cattle killed for drovers	5	
Total cattle killed		86
Paid for cattle killed from herds	$1,316 00	
Paid for cattle killed for drovers	55 00	
Total paid for cattle		$1,371 00
Total cattle tested in herds	5,178	
Total cattle tested for drovers	2,645	
Total cattle tested in State		7,823
Total cattle killed in herds	184	
Total cattle killed for drovers	9	
Total cattle killed		193
Total paid for cattle in herds	$2,904 00	
Total paid for cattle to drovers	125 00	
Total paid for cattle		$3,029 00
Paid for two horses, glanders		20 00
Total paid for diseased animals killed		$3,049 00
Total paid Members of the Commission		1,340 25
Total paid veterinarians		1,686 58
Paid Free Press Association for 1,000 Reports and 500 blanks		66 00
Paid The Caledonian Co., blanks, books and cloth posters		18 00
Total expense of Cattle Commission		$6,159 83

Average price paid for cattle killed, $15.69.

C. J. BELL, Secretary.

THE TREES OF VERMONT.

By Anna M. Clark.*

INTRODUCTION.

The following account aims to include the native and spontaneous trees of the state, together with brief mention of such others as are commonly cultivated. It is primarily addressed to readers who have little or no botanical training, but who may wish to learn the names of the trees and the characters by which they may be recognized as well as the main facts as to their occurrence and distribution in the state. It is believed that the drawings and simple keys accompanying the text will make this possible to all.

It has for some time been evident that such a publication would be widely welcomed. Vermont is a richly wooded area. Much of its wealth is directly or indirectly dependent upon its forests. Its growing fame as a region of summer homes is largely because of its attractive trees and forest areas. Moreover Vermont is peculiar in that the tree-covered areas are on the increase. It is well that this is so, for trees of the right kind are the most profitable crop that can be grown on a considerable portion of the hills and mountains of the state. The fact that this is being more emphatically taught by the board of agriculture and more commonly accepted as a guiding principle by the farmers of the state promises well for improved methods of farm and forest management during the present generation and for more valuable lands to be inherited by the next.

The intelligent fostering of this tree growth and the appreciation of its beauty as well as of its value is in a considerable measure dependent upon discriminating acquaintance with the different kinds of trees found in our forests. Few realize how many kinds there are. Within easy walking distance of the University at Burlington there occur, native, or spontaneous sixty kinds of trees. There is a greater variety of trees in the Champlain valley than in the interior of the state, yet the number of kinds to be found in any natural forest of limited area will be a pleasing revelation to one exploring it thoroughly.

It is especially to the children of Vermont and to the teachers of these children, either at home or in school, that it is hoped this publication will

*Edited by Clifton D. Howe and W. W. Eggleston.

prove most interesting and most useful. A familiar acquaintance with the common trees and other plants of the neighborhood, together with their general characters and uses should be, and before long will be, an essential part of the education of every school boy and school girl.

Each should learn to recognize so many of the trees as occur commonly in his vicinity by leaf, fruit or bark. Nor will this be found very difficult if some study is given to the following pages.

The use of technical botanical terms has been avoided. It is realized that this has in some cases been attended by a loss of precision, but the larger gains must outweigh such minor losses. In all cases the drawings are intended to supplement the keys and descriptions. They were carefully made to scale, and the reduction from natural size is indicated by the accompanying fraction. Thus white pine $\times \frac{1}{2}$ indicates that the illustration shows the parts of this pine one-half natural size.

It is highly desirable that there should be greater uniformity in the popular use of plant names and especially of the names of trees. In order to bring this about Mr. G. B. Sudworth recently prepared a list of the preferred English names of the trees of the United States (U. S. Dept. Agr., Div. Forestry, Bul. 17). The usage of this article is in accord with Sudworth's recommendations and teachers are urged to follow it. Names, other than the preferred one, which may be commonly used in the state are included in parentheses. The Latin names are in general those of Sargent's Sylva of North America. Where these differ essentially from those of the botanical manuals in common use in the state the synonyms are added.

Much help was received in the preparation of this article from Sargent's Sylva of North America and from Emerson's Trees and Shrubs of Massachusetts. The first complete discussion of the occurrence and distribution of the trees in the state is found in Oakes' list of Vermont plants, published in Thompson's Natural History of Vermont in 1842. Prof. Perkins again summarized the available information in his Flora of Vermont in 1887. The forest flora of the Connecticut valley is well discussed by Flint and Jesup in their Trees and Shrubs of New Hampshire, 1891. The information furnished in the above lists has been freely drawn upon.

C. G. Pringle very thoroughly explored the forest areas of the Champlain valley and of northern Vermont some twenty-five years ago. More recently this work has been continued by several botanists. It is not expedient here to mention the contributions of all, but credit must at least be given to those of President Ezra Brainerd regarding the flora of Addison county, of Dr. A. J. Grout regarding that of Windham county and of W. W. Eggleston regarding that of Rutland county. Mr. Eggleston has in addition made several trips through Bennington county and has also explored parts of the extensive forest areas of Essex county, thus adding much to the

accuracy of the information regarding each of these regions. As a result it is believed that the general facts concerning the distribution of the trees of the state are fairly well understood and the attempt has been made to summarize these in the present list. There is still opportunity, however, for the botanical exploration of the forests, especially in the southern and the northeastern portions of the state and it is hoped that such imperfections as exist in this publication may be a stimulus in this direction.

The preparation of the drawings *and of the original manuscript was made by Miss Clark in connection with the botanical studies of her senior year at the University of Vermont (1897–8). The publication was delayed a year and a half and the rapid increase in knowledge of the state flora during this period made some revision necessary. Mr. Clifton D. Howe had immediate charge of this revision and of the final preparation of the matter for the press. Mr. W. W. Eggleston contributed much to the value of the publication by carefully revising and editing the statements concerning the occurrence and distribution of the species, especially as regards the Connecticut valley and south-western Vermont. Professor F. A. Waugh furnished the statements about the cultivated plums and cherries and aided in other ways.

Thanks are due President Ezra Brainerd, Professor F. A. Balch, Rev. J. A. Bates, and other members of the Vermont botanical club who have kindly offered suggestions and read proofs.

L. R. JONES.

Botanical Department, University of Vermont.

September, 1899.

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*The drawing illustrating the balsam fir was made by Miss Ella K. Herrick.

TREES OF VERMONT

(*) indicates introduced species now spontaneous ; (†) occur only in cultivation.

PINE FAMILY
- Scotch pine (†)
- Austrian pine (†)
- White pine
- Red pine
- Pitch pine
- Jack pine
- Tamarack
- Black spruce
- Red spruce
- White spruce
- Norway spruce (†)
- Colorado blue spruce (†)
- Hemlock
- Balsam fir
- Arbor vitae
- Red juniper

WALNUT FAMILY
- Butternut
- Black walnut (†)
- Bitternut hickory
- Shellbark hickory
- Pignut hickory

WILLOW FAMILY
- Black willow
- White willow (*)
- Crack willow (*)
- American aspen
- Largetooth aspen
- Balm of gilead
- Cottonwood
- White poplar (*)
- Lombardy poplar (†)

BIRCH FAMILY
- White birch
- European white birch (†)
- Paper birch
- Yellow birch
- Sweet birch
- Hornbeam
- Blue beech

OAK FAMILY
- Beech
- Chestnut
- White oak
- Bur oak
- Chestnut oak
- Chinquapin oak
- Dwarf chinquapin oak
- Swamp white oak
- Red oak
- Scarlet oak
- Yellow oak

ELM FAMILY
- Slippery elm
- White elm
- Cork elm
- English (cork) elm (†)
- Scotch (weeping) elm (†)
- Hackberry

MULBERRY FAMILY
- Red mulberry
- White mulberry (*)

MAGNOLIA FAMILY
- Tulip tree

LAUREL FAMILY
- Sassafras

PLANE-TREE FAMILY
- Sycamore

ROSE FAMILY
- Apple (*)
- Pear (†)
- Crab apple (†)
- Mountain ash
- Elderleaf mountain ash
- European mountain ash (*)
- Serviceberry
- Scarlet hawthorns
- Longspine hawthorn
- Dotted hawthorn
- English hawthorn
- Canada plum
- Wild red cherry
- Choke cherry
- Black cherry
- Garden cherries (†)
- Garden plums (†)

PULSE FAMILY
- Locust
- Honey locust (†)
- Coffeetree (†)

MAPLE FAMILY
- Mountain maple
- Striped maple
- Sugar maple
- Black maple
- Silver maple
- Red maple
- Norway maple (†)
- Boxelder
- Horse chestnut (†)
- Buckeyes (†)

BUCKTHORN FAMILY
- Buckthorn (*)

LINDEN FAMILY
- Basswood

DOGWOOD FAMILY
- Sour gum

OLIVE FAMILY
- Black ash
- White ash
- Red ash
- Green ash

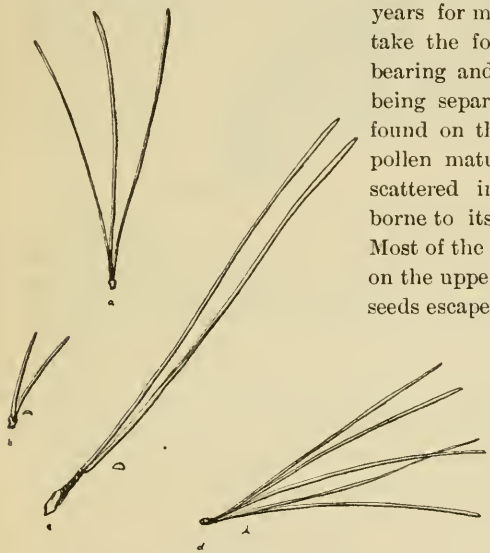
BIGNONIA FAMILY
- Catalpas (†)

PINE FAMILY.

THE PINES.

The pines are the largest and most useful group of trees included in the great cone-bearing family. There are in the eastern United States nine different species, four of which are found in Vermont.

The pines, like the other trees of this family, produce their seeds in cones. The pines are peculiar, however, in that their cones require two years for maturing. The flowers also take the form of cones, the pollen-bearing and the seed-bearing clusters being separated, though both may be found on the same tree. The yellow pollen matures in May, when it is scattered in great abundance, to be borne to its destination by the wind. Most of the seed-bearing cones develop on the upper branches, and the nut-like seeds escape from them during the second autumn. The empty cones with opened scales may thereafter cling to the tree for some time or they may soon fall.



PINE LEAF CLUSTERS
a, Pitch; b, Gray; c, Red; d, White. All × ½.

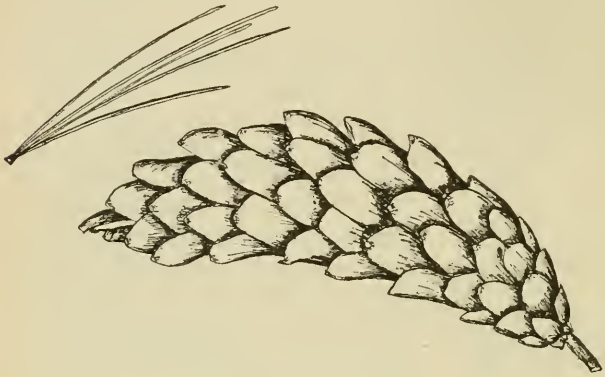
The leaves of all the evergreens cling to the branches several years. The leaves of the white pine, for example, drop when they are three or four years old. The arrangement of the leaves, or needles, in clusters of from 2 to 5, with the base of each cluster encased in a delicate sheath, offers a simple means of distinguishing the species.

Leaves 5 in each cluster..... White Pine
Leaves 3 in each cluster..... Pitch Pine
Leaves 2 in each cluster
  Leaves 4 to 6 inches long..... Red Pine
  Leaves 1 or 1½ inches long..... Gray Pine

Introduced species.—Two European pines are sometimes planted as ornamental trees in Vermont, the Austrian and the Scotch. The Scotch pine has leaves, 2 in a cluster, 2–4 inches long, flat and of a bluish-white hue. The Austrian pine has dark green, slender, rigid leaves, 2 in a cluster, 4–6 inches long.

WHITE PINE. *Pinus Strobus* Linn.

The white pine, growing as it sometimes does to the immense height of two hundred feet or more, was one of the loftiest trees of the primeval New England forest. Lumbermen have removed most of the patriarchs and only the younger trees commonly remain. The species, though widely scattered in Vermont, occurs most abundantly in the Champlain and Connecticut valleys. The slender lustrous leaves are borne in close clusters and give a beauty and delicacy of foliage possessed by no other pine.



WHITE PINE
Cone and leaf cluster, ×½.

The white pine takes its name from the color of its wood, which is soft, easily worked and is much used in all kinds of light woodwork. It is especially sought for inside house finishing. It is one of the most valuable and most rapidly growing timber trees in the state. The renewal of the pine forests should therefore be encouraged.

RED PINE (NORWAY PINE). *Pinus resinosa* Ait.

The red pine is much less common in Vermont than the white pine. Scattered groups or small groves of it occur on the dry, rocky headlands of Lake Champlain and it may be found in similar soils in the river valleys throughout the state, although it is less frequent in the southern portions. Its heavier clusters of foliage with long leaves in pairs, serve to make its recognition easy. The cones are about two inches long at maturity.

The name red pine is appropriate both because of the pale red color of the heart-wood and the distinctly reddish cast of the bark. This species does not grow in Norway or elsewhere in Europe, and it is said that it received the name from the town of Norway, Maine. The name Norway pine has so little fitness as applied to this tree, and is so evidently misleading that its use is to be discouraged.

The Latin name suggests a resinous wood, but in fact it is less so than either of the other pines. The wood is light, hard, close grained, and is largely used for bridge and building timbers. The picturesqueness and individuality of the red pine commend it for wider use as an ornamental tree.

PITCH PINE. *Pinus rigida* Mill.

The pitch pine is one of the more southern species, and is nearly at its northern limit in Vermont. The pines all flourish in light soils, but the pitch pine seems to thrive best in dry barren sand plains. In such locations it occurs abundantly in the northern parts of the Champlain valley, especially along the lower courses of the Winooski, Lamoille and Missisquoi rivers. It is also scattered along the Connecticut river valley.

In suitable places it forms dense groves of small trees, forty to sixty feet in height. The individual trees are sometimes picturesque but not graceful or otherwise very attractive in appearance. The branches of even the smaller trees mature numerous cones, which are long persistent. They are about two inches long and have the scales tipped with sharp recurved prickles, a character which may aid in the recognition of the species.

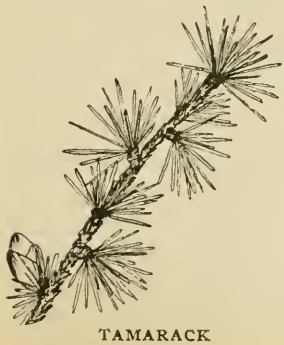
The wood is hard and resinous. Turpentine and tar were formerly obtained from it in New England. This resinous quality adds to its value as a fuel and for kindling wood. This is the principal use made of it at present.

JACK PINE (GRAY OR SCRUB PINE). *Pinus divaricata* (Ait) Du Mort., *P. Banksiana* Lamb.

The gray pine is the smallest of the Vermont pines with sprawling habit and short stout leaves, giving the tree a bristly, stunted appearance. Its characteristic cones are pointed and curved toward the main axis of the stem, often partially encircling it. The gray pine is a northern species extending to the Arctic region, and the line of its southeastern limit passes through northern Vermont. It is one of the rarest of our trees, and but few specimens are known to occur in the state. Mr. Rowland E. Robinson of Ferrisburgh discovered a small grove of it in 1860. Scattered trees have since been found in Monkton, Starksboro and Fairfax. It probably occurs in other places in northern Vermont. The remaining trees should be sought out and spared because of their scientific interest.

TAMARACK (HACMATACK, LARCH). *Larix laricina* (Du Roi), Koch., *L. Americana* Mich.

The tamarack is our only cone bearing tree which drops its leaves in the autumn. It is an attractive, conical tree, its graceful form and full clusters of slender, delicate leaves giving it well-marked individuality. Its deep red fleshy cones, which open in June, are as pretty as flowers.



TAMARACK
Branchlet and cone, × ½.

The wood is coarse grained but very strong and remarkably durable in contact with the soil. This fact gives it especial value for fence posts, telegraph and telephone poles and railway ties, much of the Vermont tamarack being used for these purposes. It is also used for dock planking.

The tamarack occurs commonly throughout the state. While it is usually found in

swamps it is said that it will grow more rapidly when transplanted to dry ground. This fact adds to its desirability for ornamental planting.

THE SPRUCES.

Every Vermonter should know and appreciate the spruces. The mountain spruce and the sugar maple are the most characteristic trees of the state. The forests of North America contain seven species of spruce, three of which occur in Vermont.

The spruces are northern trees, and Vermont lies rather south of the belt of their most abundant growth in northeastern America. It is therefore our mountain sides and cool swamps which furnish conditions suitable for their best development.

The flowering cones are similar to those of the pine in general characters. The flowers appear in spring and the cones mature the following autumn, the seeds being shed during autumn or early winter.

Until recently botanists considered the two species, here described as the red and the black, to be simply varieties of one species, which then went under the common name of black spruce. In the lumber trade all three kinds are handled, without discrimination, as "spruce." As a matter of fact, the red spruce furnishes nearly all of the spruce lumber of this state. Spruce gum also comes chiefly from the red spruce, although it is formed by the other species.

Branchlets coated with minute hairs.
- Cones 1–1¼ inches long, clinging to the branches many years; scales of cone toothed at outer margins; leaves blue-green, paler underneath ..... Black Spruce
- Cones 1–2 inches long, generally deciduous by the second summer, scales of cone with outer margins not toothed; leaves yellow-green. Red Spruce

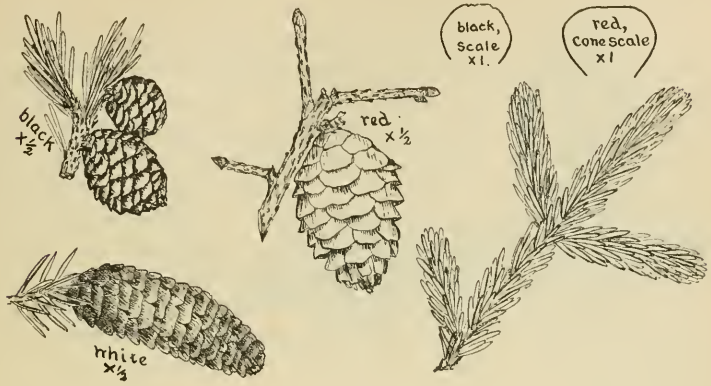
Branchlets without hairs.
- Cones slender, 1–2½ inches long, leaves blue-green ..... White Spruce

Introduced species.—The Norway spruce (*Picea excelsa*) is commonly cultivated in Vermont door yards, parks and cemeteries, and is superior to our native trees for such purposes. It is easily recognized by its more pendulous branches and very large slender cones, 5 to 7 inches long.

The Colorado blue spruce (*P. pungens*) is occasionally planted. This is characterized by its beautiful glaucous-blue foliage. The cones are three to five inches long.

BLACK SPRUCE (SWAMP SPRUCE). *Picea Mariana* (Mill.) B. S. P., *P. nigra* Link.

This is the common spruce of the sphagnum (peat moss) swamps of the Champlain valley. It is also common in Essex county and probably occurs similarly in the other parts of the state, but the distribution is not well known because of its confusion until recently with the red spruce. A small sterile semiprostrate form occurs on the extreme summit of Mt.



SPRUCES

Branch, cones and cone-scales.

Mansfield. (Eggleston.) Under the most favorable circumstances it is never a large tree, rarely reaching a diameter of one foot or a height of fifty feet. It is therefore a less valuable timber tree than either the red or the white spruce.

It has frequently been planted in Vermont as an ornamental tree. This is unfortunate, as the lower branches soon die, making it the least attractive of our native evergreens.

RED SPRUCE. *Picea rubens* Sargent, *P. nigra rubra* Engelm.

This is the common spruce of our mountain forests, the vast green expanse of which suggested the names of both mountain range and state. It is not commonly distinguished from the preceding species and both are known as black spruce. It attains a height of from seventy to one hundred feet and large logs may be three or more feet in diameter. When growing in open fields it often forms a conical head with the branches, especially of the younger trees, brushing the ground. In the more typical development, especially when in crowded forests, the lower branches soon perish, leaving the long naked trunks which the lumberman prizes.

The wood is light, soft and less durable than pine when exposed to the action of the weather. It is largely used for building timber and for clapboards and shingles. Owing to the fact that it imparts no flavor, spruce is used in the manufacture of butter tubs and boxes. Great quantities are consumed in the pulp mills. It is a tree of slow growth, large specimens in the primitive forests being often two hundred to three hundred years old.

The red spruce is frequently planted as an ornamental tree in Vermont, but its slower growth and less symmetrical form make it less desirable for this purpose than either the native white spruce or the Norway spruce.

WHITE SPRUCE. *Picea Canadensis* (Mill.) B. S. P., *P. alba* Link.

This is a northern tree, which extends from Canada into northern Vermont. It occurs along the Connecticut river to the Fifteen Mile Falls, (South Lunenburgh), and on the eastern arm of the Y of the Green mountains to the Montpelier and Wells River railroad, or perhaps a little farther south. It is common on some of the islands of Lake Champlain and is scattered through the forests of Essex county. The strong polecat odor of the young branches is characteristic and will aid in its recognition. Because of this odor it is often called skunk spruce. Lumbermen do not separate this from the other spruces and the tree is nearly equal in size to the red spruce.

The white spruce is one of the best of our native evergreens for ornamental planting, as it makes a rapid growth and with its persistent lower branches forms a perfect and symmetrical conical head which rivals the Norway spruce.

HEMLOCK. *Tsuga Canadensis* (Linn) Carr.

The hemlock is one of the most graceful of our evergreen trees. It may be met with almost everywhere from the low river banks and swamps to the rocky hillsides and mountain forests. In distinguishing the hemlock from the spruce and balsam fir, one should notice the flat, petioled leaves arranged in a flattened spray with a row on the upper surface lying close to the stem. The small elliptical cones, scarcely more than three-fourths of an inch long, mature in the autumn and shed their seeds during the winter.

HEMLOCK, spray and cone, ×⅔.

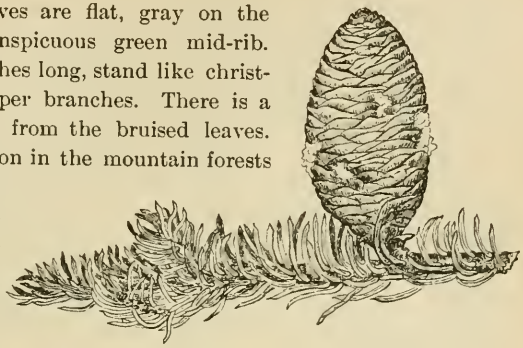
The wood of the hemlock is soft, brittle and shaky and it is used for cheaper building purposes and for shingles. It is, however, one of the most durable timbers for use under water. Hemlock bark is used for tanning and the bark from the tree is quite as valuable as the lumber.

BALSAM FIR. *Abies balsamea* (Linn) Mill.

The balsam fir, more familiarly known as the fir tree or balsam, is a slender graceful tree when growing in open ground. It bears a general resemblance to the spruces, but is easily distinguished from them on close

observation. The leaves are flat, gray on the under side, with a conspicuous green mid-rib. The erect cones, 2–4 inches long, stand like christmas candles on the upper branches. There is a characteristic fragrance from the bruised leaves. The balsam fir is common in the mountain forests throughout the state. It ascends to the highest summits of Mt. Mansfield and Camel's Hump but is there reduced to a low, scrubby growth.

The wood is light, soft and not durable. It makes a medium quality of shingles.



BALSAM FIR

Branchlet and cone, × ½.

ARBOR VITÆ (WHITE CEDAR). *Thuya occidentalis* Linn.

This is a member of the cypress family, and the only one native to this latitude. It is popularly known in Vermont as the white cedar. This is an unfortunate misnomer, since the true white cedar is a different tree of more southern range. The arbor vitae is easily recognized by its striking pyramidal habit of growth and, upon closer examination, by its small, scale-like leaves, in four rows, but so flattened on the branchlets as to form fan-like sprays.

ARBOR VITÆ, × ⅔.

It occurs commonly in the northern part of Vermont upon cool, moist hillsides and in swamps, becoming less frequent in the southern portions of the state. The bark and fibers twist spirally around the axis, making a shaft of great strength, and the straight slender trunks are of especial value for posts and telephone poles. Few timbers withstand decay in the soil better than the arbor vitae, fence posts sometimes lasting thirty or forty years. It is commonly planted for hedges and other ornamental purposes.

RED JUNIPER (RED CEDAR). *Juniperus Virginiana* Linn.

Three kinds of juniper are found in the state, but this one, commonly known as red cedar, is the only one which has the size and habit of a tree. It occurs on dry, rocky hills, being common along the bluffs of Lake Cham-

plain, less so in the mountain range of southwestern Vermont. It occurs more or less commonly in the Connecticut valley north to Fairlee. (Flint).

RED JUNIPER, × ⅔.

It somewhat resembles the arbor vitæ, from which it may be distinguished at a distance by its less symmetrical form and darker foliage. Closer inspection shows that its scale-like leaves have little tendency to the arrangement in a plane which is characteristic of the arbor vitæ. The fruit is also readily distinguishable from that of the other cone-bearing trees. It consists of thick fleshy scales which coalesce to form a structure looking more like a small berry than a cone, green in midsummer, becoming bluish at maturity in the autumn. The leaves of young shoots are longer than are those on the older branches, with needle-like points.

The heart-wood of this tree is soft, red and fragrant, and that obtained from the southern states is largely used in the manufacture of pencils. Most of the Vermont trees are used for fence posts, which are found to be very durable. In some localities of the state oil is distilled from the leaves and wood.

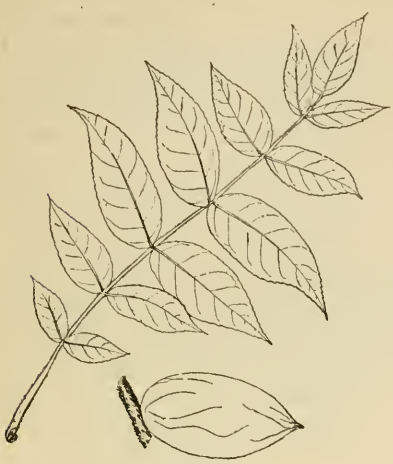
The branches are often loaded with "cedar apples." These are fungus growths and are noteworthy because the spores from them develop as a destructive rust upon adjacent apple trees. Hence red cedars should not be planted near an orchard.

WALNUT FAMILY.

BUTTERNUT (WHITE WALNUT). *Juglans cinerea* Linn.

Every school boy in Vermont has some acquaintance with this tree and its sweet tender nuts. It occurs along the hillsides and river valleys throughout the state. The staminate flowers, appear in May and hang in graceful, slender catkins five or six inches long. These are generally found on the second year shoots while the fruit-bearing flowers are borne on the terminal shoots. Butternut trees show some irregularities, however, in reference to the time and order of the appearance of the two kinds of flowers so that the pollen-bearing clusters may mature either some ten days earlier or later than the fruit-bearing ones on the same tree. This may be the cause of the variability often noticed in the crop of butternuts. The peculiarity offers an interesting subject for further observation.

The meat of the butternut needs no recommendation but the excellencies of pickles made from the young mucilaginous nuts are not so well



BUTTERNUT.
Leaf and fruit, × ⅓.

known. For this purpose they should be gathered early in June and the clammy pubesence removed by plunging them into boiling water and rubbing with a coarse cloth.

The wood of the butternut is soft and not strong but takes a beautiful, dark polish and is used especially for interior finishings.

Introduced species.—The black walnut is occasionally cultivated. It may be transplanted or grown directly from the nuts, and develops rapidly into a beautiful tree, valuable both in its nuts and wood.

THE HICKORIES.

The hickories are stately trees, quite generally distributed throughout the United States. There are eight species, all peculiar to America, several of which produce edible nuts. Among the latter are the shellbark hickory in the north and the pecan in the south.

The flowers, arranged in catkins of the two kinds, appear in late spring after the unfolding of the leaves.

The wood of all these trees is heavy, tough and durable. It is used for axe handles, agricultural implements and in places where strength and elasticity are required it is almost unrivaled.

The hickories are frequently but erroneously termed "walnuts," in the popular language of New England. The true walnuts of which the butternut and black walnut are the American representatives differ from the hickories, although they are closely related.

Nut sweet and edible, bark shaggy, leaflets 5 (rarely 7).....Shellbark Hickory
Nut more or less bitter, not edible, bark close.
Fruit globular, nut thin-shelled, leaflets 7-11.....Bitternut Hickory
Fruit pear-shaped, nut hard-shelled, leaflets 5-7.....Pignut Hickory

SHELLBARK HICKORY (SHAGBARK HICKORY, WHITE WALNUT). *Hicoria ovata* (Mill.) Britton, *Carya alba* Nuttall.

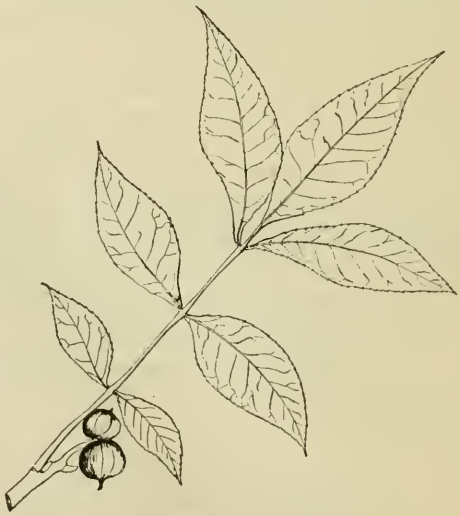
Two points alone are sufficient to distinguish the shellbark from other hickories; its dark brown bark scaling off irregularly in long slender strips and its compound leaves rarely consisting of more than five leaflets. This

SHELLBARK HICKORY
Leaf and young fruit, × ⅓.

is the hickory nut of the markets. It is quite common in the moist soils of the Champlain valley. It occurs in the Connecticut valley as far north as Windsor also in the White river valley at Royalton. There is a large grove on the south side of Bald Mountain in Shrewsbury at an altitude of about 1500 feet. The value of hickory timber for certain manufacturing purposes has already been mentioned. It is also valued for fuel, yielding more heat to the cord than any other native tree.

BITTERNUT HICKORY (BITTER WALNUT). *Hicoria minima* (Marsh) Britton, *Carya amara* Nuttall.

Three characteristics of the bitternut are to be kept in mind in distinguishing it from the pignut, namely, its globular, thin shelled nuts, its small, pointed, yellow buds and its leaves consisting of seven or more slender leaflets. The bitternut does not occur in our mountain forests but is not uncommon with the shellbark in the Champlain and Connecticut valleys. Besides being a desirable ornamental tree, the bitternut produces wood scarcely inferior to that of the shellbark hickory for fuel or manufacturing purposes.



BITTERNUT HICKORY
Leaf and fruit, × ⅓.

PIGNUT HICKORY. *Hicoria glabra* (Mill.) Britton, *Carya porcina* Nuttall.

This species is apparently confined to the southeastern and southwestern portions of the state. The following statements summarize the present information as to its distribution. It is a common tree in the Hoosac valley, Pownal (Eggleston). In the Connecticut valley it is abundant on the hills near the river in the vicinity of the Massachusetts line, but is not common above Bellows Falls, (Flint). A large grove occurs on the shore of Lake Bomoseen, West Castleton and a few trees near the Hubbardton line in East Castleton, (G. H. Ross).

PIGNUT HICKORY
Leaf and fruit, × ⅓.

Observers of trees in southern Vermont should strive further to increase our knowledge of its distribution.

In distinguishing this from the bitternut, notice the pear-shape fruit, thick-shell nut, the generally smoother bark and the fewer leaflets, (5-7, rarely 9.) It reaches its most northern limit in this region and will probably be found only in the more sheltered river or lake valleys. The lumber of the pignut is of similar value to that of other hickories and is used for like purposes.

WILLOW FAMILY.

THE WILLOWS.

The amateur botanist who tries to distinguish the willows, soon finds himself in an inextricable tangle. This is partly because several European species and varieties have been naturalized and partly because the willows hybridize and rehybridize so frequently. Fourteen native and three introduced species are found in Vermont, only three of which attain the size of trees. The shrubby species vary in height from the common pussy willow (*Salix discolor*) which is sometimes fifteen or twenty feet high and almost a tree, down to the prostrate alpine willows found only under the northeastern slope of the "chin" of Mt. Mansfield, where they raise their heads but a few inches above the moss in which the stems are imbedded.

Willows are commonly introduced as shade trees because they are so easily propagated by cuttings. Care should be taken, however, to select the stamen-bearing trees, both because these are more ornamental when in flower and because they do not produce the downy fruit which is often disagreeable when they are growing near houses.

The following key, while not entirely satisfactory, may aid in recognizing the three tree willows.

Smaller, slender, native trees, bark rough, twigs dark.....Black Willow
Larger, spreading, introduced trees.
Twigs yellow, young leaves ashy-gray or silver-white on both sides .....White Willow
Twigs blue-green, young leaves green above, paler beneath.....Crack Willow

BLACK WILLOW. *Salix nigra* Marsh.

BLACK WILLOW
Leaf and flowers, staminate above, pistillate below, × ⅓.

The black willow is a slender, rather graceful tree, common everywhere, along the banks of lakes and streams. It may usually be recognized by its stouter dark brown or black twigs in contrast with the more slender, yellowish or bluish-green twigs of the European species. When the pendulous catkins open, three, five or more stamens may be found in each tiny flower. The leaves are green when mature and smooth except on the mid-veins and petioles.

WHITE WILLOW (YELLOW WILLOW). *Salix alba vitellina* Koch.

The white willow was introduced from Europe, but it has been so commonly planted and is so frequently spontaneous along the banks of streams and lakes, that it merits a place in this list. If one observes closely the tiny staminate flowers in May both this and the next species are clearly distinguished from the black willow since there are but two stamens in each flower, whereas the black willow has from three to six. Usually, however, one must depend upon other and less definite characters. A little practice, following the suggestions giv-

WHITE WILLOW
Leaves and pistillate flower, × ⅓.

en in the above key, will enable one to distinguish the native black willow from the introduced species. Nor will it be found difficult to distinguish typical trees of the white willow from typical trees of the crack willow by the characters given in this key. As a matter of fact, however, there are numerous varieties and hybrids between these two willows which it is impossible to classify under either name.

The white willow is large and graceful, and this, coupled with the ease of starting it from cuttings, makes it a deservedly popular shade tree.

CRACK WILLOW. *Salix fragilis* Linn.

Most of the statements made in the discussion of the white willow apply to this species also. A distinctive characteristic of the twigs, aside from their color, is that they are very brittle, especially near the base, whence the name.

THE POPLARS.

The poplars belong to the willow family and resemble the willows especially in flower and fruit characters. The nodding, worm-like, staminate and pistillate catkins are borne upon different trees and, opening before the leaves, are conspicuous in early spring. The poplars are quite widely distributed, extending from the Arctic circle to Mexico and from the Atlantic to the Pacific.

The wood of poplars is very soft and light and especially liable to warp, but is cheap and useful for making toys, boxes and smaller furniture. Much of it now goes to the pulp mills.

Leaves coarsely and bluntly toothed or scalloped.
- Leaves roundish, especially at the base.....Largetooth Aspen
- Leaves triangular, with straight or truncate base.....Cottonwood

Leaves finely toothed.
- Leaves small, nearly as broad as long, petioles much flattened.....American Aspen
- Leaves larger usually much longer than broad, petioles not flattened. Balsam Poplar

Introduced species.—In addition to these native poplars two European species are very commonly planted, the Lombardy poplar, (*P. nigra Italica*) recognized by its tall spire-like form, and the white poplar, (*P. alba*) easily distinguished by its leaves, green above and very white-cottony beneath.

ASPEN (AMERICAN OR QUAKING ASPEN). *Populus tremuloides* Michx.

The most careless observer cannot have failed to notice the leaves of the aspen continually trembling on the quietest summer day. This tremulousness has, indeed, given name to the species. The reason for it, as may readily be seen by examination of any leaf, lies in the decidedly flattened

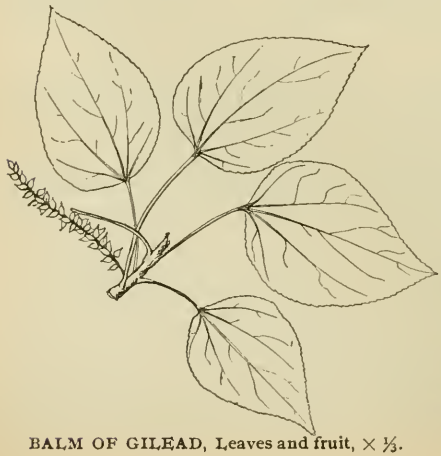
AMERICAN ASPEN
Leaves and flowers,
1 staminate, 2 pistillate, × ⅓.

structure of the leaf-stem or petiole. The slender drooping catkins appear in early spring and the downy fruits ripen in the latter part of May. The American aspen grows to a medium size, and is the most widely distributed tree in North America, extending from Labrador to Alaska, from Lower California to the Atlantic coast. It is found everywhere in Vermont.

LARGETOOTH ASPEN. *Populus grandidentata* Michx.

The name of this tree suggests an easy way of identifying it. The coarse toothed margin of the leaf is a constant characteristic and may be relied upon. The pollen-bearing catkins may be seen first, a little later the seed-bearing catkins appear on other trees. The fruits ripen when the leaves are unfolding. The young leaves are downy-white on both sides, but later become green and smooth. The largetooth aspen is of common occurrence in Vermont. It flourishes best on rich sandy soil.

LARGETOOTH ASPEN
Leaves and flowers, pistillate above, staminate below, × ⅓.



BALM OF GILEAD, Leaves and fruit, × ⅓.

BALM OF GILEAD (BALSAM POPLAR). *Populus balsamifera* Linn.

This tree, common on the banks of streams and along our roadsides, is a northern species ranging from northern New England far north to the Alaskan coast. It is subject to great variation in the form of the leaves. Some are almost triangular with a deeply heart-shape base, while others are very slender with a wedge-shape

base. The buds and young leaves are covered with a gummy excretion which is sometimes soaked out and used in preparing ointments. It is frequently planted as a shade tree.

A variety of this species (var. *candicans* Gray) has broader leaves, more inclined to heart-shape and minutely hairy on the petiole and margins. It is to be sought along our northern borders and in cultivation.

COTTONWOOD. *Populus deltoides* Marsh., *P. monilifera* Ait.

COTTONWOOD, × ⅓.

In Vermont the cottonwood occurs native in the valley of Lake Champlain and along its tributary streams, and south in western Vermont through the Hoosac valley in Pownal where it is particularly abundant. It occurs along the Connecticut river in southeastern Vermont at least as far north as Brattleboro. It has been planted as a shade tree in other localities. For this purpose the stamen-bearing trees should always be chosen since the abundant, cottony, seed is a nuisance near dwellings. The leaves occasionally vary to a heart-shape or even wedge-shape base, but the deltoid (triangular) form is so characteristic as to give name to the species.

The cottonwood is the most massive of our deciduous trees, sometimes 100 feet in height and with a trunk 5 to 7 feet in diameter. Such isolated giants have become the familiar landmarks of many roadsides near Lake Champlain.

BIRCH FAMILY.

THE BIRCHES.

The birches are widely distributed over the old and the new worlds, being most abundant in the higher latitudes. Nine species occur in North America, four of which are found in Vermont. They are all graceful trees with slender flexuous branches and delicate foliage. Both the fruit-bearing and pollen-bearing flowers are found on the same tree, but in separate clusters. The staminate catkins are long and drooping, while the pistillate are shorter and not pendulous until fruited.

The wood of birches is valued chiefly for cabinet making, for spools and other small articles.

The following key is based largely on the bark characters. It is to be noted that these characters are not well developed on saplings and may be lost on some old trunks.

Bark white.
Leaves nearly triangular, saw-tooth or lobed, long taper-pointed, bark close. ..... White Birch
Leaves ovate, saw-toothed, bark in easily separable layers, often ragged..Paper Birch
Bark dark-brown or black, close, sweet, aromatic.....Sweet Birch
Bark silvery-yellow, in layers, often ragged.....Yellow Birch

Introduced species.—The European white birch (*B. alba*) is commonly planted for ornamental purposes. It is a beautiful tree closely resembling the native white birch. There are numerous horticultural varieties, some with finely cut leaves and pendulous branches.

WHITE BIRCH (GRAY BIRCH). *Betula populifolia* Marsh.

WHITE BIRCH
Leaves and fruit, × ⅓.

The white birch is at best but a small, short-lived tree, but it grows in such numbers that it is sure to attract attention. The points which distinguish this birch are its triangular, slender, taper-pointed leaves, smooth-shining on both sides, and its smooth, close, creamy-white bark. Both the staminate and the pistillate catkins open before the leaves in the spring.

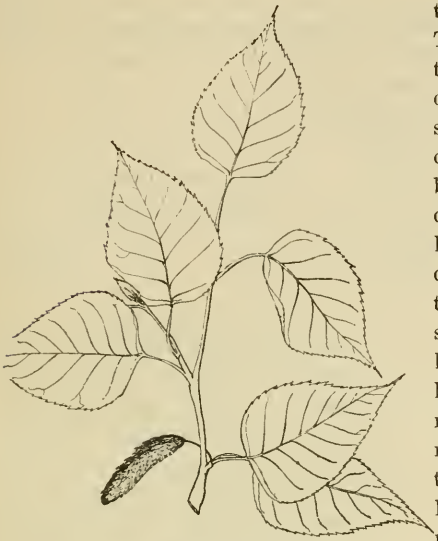
It is most abundant in the lighter soils, either moist or dry in the Champlain valley. It never reaches the higher altitudes, 1800 feet being the highest reported by Dr. Sargent. In the Connecticut valley it is reported by Flint only as far north as Westmoreland, N. H.

It never reaches sufficient size to become a valuable lumber tree, but its light elastic stem is always in demand for spools, shoe-pegs, and barrel-hoops.

The white birch with its white trunk and graceful branches and light, delicate foliage is one of our most beautiful trees, but its desirability for transplanting is lessened by its short life and liability to injury from storms.

PAPER BIRCH (CANOE BIRCH). *Betula papyrifera* Marsh.

The paper birch is found in cool soils in all parts of the state, being typically a tree of more northern distribution than is the last species. It is, however, often intermingled with the white birch and is popularly confused with it, although careful observation reveals many characteristics by which



PAPER BIRCH
Leaves and fruit, × ⅓.

the two may be distinguished. The paper birch is a larger tree than the white and more widely distributed. The two species are similar in the chalky whiteness of the bark, but that of the white birch clings closely so that it cannot be separated in large layers, whereas the peculiar character of the paper birch is the ease with which ample sheets of the beautiful corky layers may be removed. The larger size of the paper birch makes its lumber more useful for manufacturing purposes than that of the white. A dwarf form known as variety *minor*, which reaches a height of but a few feet occurs on the exposed summit of Mt. Mansfield.

SWEET BIRCH (BLACK BIRCH, CHERRY BIRCH). *Betula lenta* Linn.

The distinctive characters of this tree are well known to many Vermonters, who, as children, have become familiar with the sweet winter-green flavor of bark and leaves. It is common in western Vermont, but reaches only the foot-hills of the Green Mountains. Its northern limit in the Connecticut valley is in the vicinity of Norwich.

The two kinds of catkins are noticeable upon the bare trees in winter; and they open on the first spring days, before most other trees have made a visible response to the sun's rays. The wood is hard, strong and valuable for furniture and fuel.

SWEET BIRCH
Leaves and fruit, × ⅓.

YELLOW BIRCH (GRAY BIRCH). *Betula lutea* Michx.

The polished silvery-yellow bark of the mature tree marks the yellow birch almost as clearly as does the white bark in the case of the preceding species. On the oldest trees in the primeval forest, however, the bark becomes a darker bronze and rough. It is common in nearly all parts of Vermont, but especially in rich, cool soils, and it extends far up the sides of

our higher mountains. During the winter the little catkins remain tightly closed, but by June they lengthen into slender, drooping clusters. Yellow birch lumber is valuable for many purposes. It takes a beautiful polish, and is becoming increasingly popular for furniture and for flooring.

Because of its graceful form and attractive, yellow bark, it merits more general usage for ornamental planting.

The general similarity of the leaves and fruit of this species to those of the paper and black birches, renders further illustration unnecessary.

HORNBEAM (IRONWOOD, LEVERWOOD, HOP HORNBEAM). *Ostrya Virginiana* (Mill.) Koch.

HOP HORNBEAM
Leaves and fruit, × ⅓.

Hornbeams are sometimes mistaken and transplanted for elms, owing to the general similarity in the appearances of the young trees. The leaves of the hornbeam, however, are nearly symmetrical at the base, while those of the elm are more unequally developed. In late summer the hornbeam is easily distinguished by its fruit hanging in hop-like heads.

The hornbeam is quite generally distributed, both in the valleys and the mountainous parts of the state, but is most common in the western and southern portions. It is a small tree. The wood is very strong, tough, and durable in contact with the soil, hence the names ironwood, lever wood. It is used for levers, mallets and for fencing materials.

BLUE BEECH (WATER BEECH, HORNBEAM, IRONWOOD). *Carpinus Caroliniana* Walt.

BLUE BEECH
Leaves and fruit, × ⅓

The blue beech is a small, bushy tree rarely over twenty feet high. It is not uncommon in moist soil along streams, but does not reach the higher altitudes. It is distinguished in spring by its tiny flowers arranged in loose racemes and in July by the curious leaflike wings which develop upon the fruit. A glance at its trunk makes its recognition certain at any time of year,

however. This has a close, gray bark resembling that of the beech but with furrows and ridges suggesting the muscles of a strong man's arm. It is the toughest of all our woods.

OAK FAMILY

BEECH. *Fagus Americana* Sweet, *F. ferruginea* Ait.

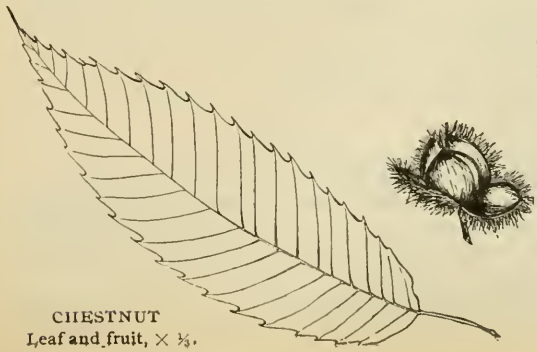
The beech, when growing in the forest, with its tall, graceful trunk, its smooth, gray bark and shiny leaves, is a handsome tree. It is not only one of the most common trees in Vermont, but also one of the most widely distributed in eastern North America.

BEECH
Leaves and fruit, × ⅓.

The drooping clusters of pollen-bearing flowers and the short, stout fruit-bearing heads open under the newly spreading leaves in early May. The burs open and the nuts fall with the first frosts of autumn. There is a popular saying that beech nuts occur plentifully only once in seven years. There certainly is great irregularity in the fruiting of the beech. What is the reason? This is an interesting question for some one to investigate.

The wood is quite hard and makes the best of flooring. It is also used in the manufacture of bench planes and similar tools and for fuel.

CHESTNUT. *Castanea dentata* (Marsh.) Bork., *C. sativa Americana* Wats.



CHESTNUT
Leaf and fruit, × ⅓.

Unfortunately the chestnut is not found in most parts of the state. It occurs in southeastern Vermont along the Connecticut valley as far north as Windsor. In the southwestern part of the state it is found well scattered in the Taconic range from Pownal to

Manchester. A grove occurs at West Rutland and there are native trees upon Rock Point near Burlington. This is the most northern station in New England. The chestnut will probably grow in all parts of the state and may well be cultivated both for its delicious nuts and for its beauty as a shade tree.

The leaves are shiny and graceful, from six to eight inches long. When they are nearly grown, long, stiff catkins of fragrant, greenish-yellow flowers appear. These bear the pollen, the fruit-bearing flowers being smaller, enclosed in bur-like scales. The nuts, two or three in a bur, ripen in October.

THE OAKS

The oaks, abundant throughout the northern hemisphere, are remarkable for their massive trunks, for their thick, rugged bark and large, strong roots. They are distinguished from all other trees by their cupped fruit, but many who have seen these fruits have not noticed the small, scaly masses of flowers which produce them. The pollen-bearing flowers are found on the same tree, but are arranged in long, slender catkins consisting of a cluster of from three to twelve stamens. Some of the oaks, including the red and black, do not mature their fruit until the second year.

Oak timber is of great commercial value, being used for a variety of purposes. For strength, hardness, toughness and durability combined, it is unsurpassed.

The oak genus is a large one. Ten species are known to occur in Vermont, and these sometimes hybridize, producing intermediate forms. The bear oak or scrub oak, is a straggling shrub, occurring sparingly in southeastern Vermont. The other nine species are trees. Of these four are rare or local in their occurrence, as follows :

The dwarf chinquapin oak, *Q. prinoides*, dry hillsides, Pownal (Robbins, Eggleston), Weybridge (Brainerd).

Chinquapin oak, *Q. acuminata*, Gardiner's Island, Lake Champlain, (Pringle).

Bur oak, *Q. macrocarpa*, in the Champlain valley, more common in Addison county than elsewhere.

Scarlet oak, *Q. coccinea*, Pownal (Eggleston).

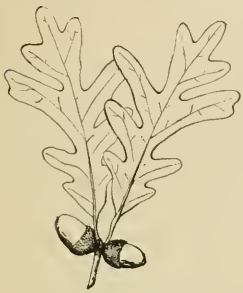
The other five are of more common occurrence ; the following key will aid in distinguishing them.

Lobes of leaves obtuse, not bristle-pointed, fruit annual.
- Leaves usually deeply-lobed (½- or ⅔-way to midrib).....White Oak
- Leaves scalloped or shallow-lobed (less than ⅓-way to midrib), stalk of acorn much longer than leaf-stalk.....Swamp White Oak
- Leaves undulate-toothed (crenate), stalk of acorn shorter than leaf-stalk..Chestnut Oak

Lobes of leaves acute, bristle-pointed, fruit biennial.
- Acorn large, cup ¾-1 inch broad, shallow, saucer-shaped.....Red Oak
- Acorn small, cup ½-¾ inch broad, hemispherical or top-shaped.....Yellow Oak

WHITE OAK. *Quercus alba* Linn.

The white oak is the most beautiful as well as the most useful of the oaks found in this part of the United States. Vermont has quite a generous supply of these trees in the Champlain valley. Flint states that it occurs but sparingly in the southern Connecticut valley and disappears before the mouth of the Passumpsic is reached. Both kinds of flowers appear at the same time, the staminate being more conspicuous on account of their drooping clusters. The acorns ripen and fall during the first autumn.



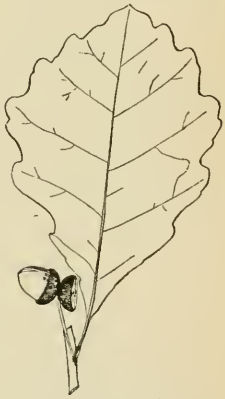
WHITE OAK
Leaves and fruit, × ⅓.

The tough, heavy wood of the white oak needs no recommendation. On account of the beauty of its grain and its capability of taking a high polish, it is extensively used for furniture and for inside finishings. It is also much used in carriage manufacture and for car and bridge timbers.

The famous "Charter Oak" of Connecticut was of this species.

SWAMP WHITE OAK. *Quercus platanoides* (Lam.) Sudworth, *Q. bicolor* Willd.

In beauty and variety of grain this tree nearly equals the white oak and its wood is valuable for similar purposes. As its name suggests it grows in low, moist soil. Unfortunately the swamp oak is not found in Vermont except along the intervales of Lake Champlain and its tributaries. Here it is quite abundant and its majestic size and symmetrical, rounded top make it a conspicuous and beautiful tree. It is more easily identified than many of the oaks because of the scaly bark, the leaves downy on the lower surface and the long, downy stalks of the acorns. The flowers open late in May and the fruits ripen the following autumn.



SWAMP WHITE OAK
Leaf and fruit, × ⅓.

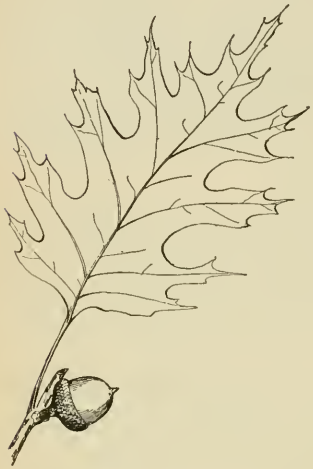
CHESTNUT OAK. *Quercus prinus* Linn.

The popular name of this oak is suggested by the marked resemblance of its leaves to those of the chestnut. It is one of the common oaks from Massachusetts and New York southward, forming a large tree on rocky hillsides, often associated with the chestnut. The line of its northern distribution passes through the Champlain valley. It is common on Snake mountain and the quartzite range of the Green mountains in Addison

county (Brainerd) and thence south through Rutland and Bennington counties. It probably occurs in the southeastern part of the state also.

The acorns are large, one inch or more in length. The wood is hard and tough and is frequently used for railroad ties.

RED OAK. *Quercus rubra* Linn.



RED OAK
Leaf and fruit, × ⅓.

The red oak is the most northern of all the oaks, ranging from Nova Scotia to Tennessee. It is generally distributed through the Champlain and lower Connecticut valleys where it is the most common oak. It is less common in the northern part of the Connecticut valley. The flowers appear in May but the sessile, shallow-cupped acorns do not ripen until the second autumn.

The wood is lighter in weight and more brittle than that of the white oak but when quartered shows a beautiful grain and is used for furniture. It is also valued for bridge posts where there is to be exposure to water. The wood drys out slowly and is inferior as fuel.

YELLOW OAK (BLACK OAK). *Quercus velutina* Lam., *Q. coccinea tinctoria* Gray.

The yellow oak is a southern species which reaches its northern limit in Vermont. It is not uncommon in light, dry soils in the Champlain valley and it occurs also in the southern part of the Connecticut valley. The two common and apparently incompatible names, yellow oak and black oak, arise from the diverse colors of the inner bark and the outer bark. The former, which is used in tanning, is yellow, while the latter is very dark. The leaves are rather large, dark, shiny green with yellowish petioles. The acorns do not ripen until the second autumn. The wood is hard and tough like that of the white oak and is used in manufacturing.

YELLOW OAK
Leaf and fruit, × ⅓.

ELM FAMILY.

THE ELMS.

We are fortunate in having in Vermont all of the elms of the eastern United States except one small southern species. The tiny greenish flowers have no petals but gracefully fringe the bare trees with their long, slender stamens in early spring before the appearance of the leaves. The fruits are supplied with a disk-like membranous wing. The leaves of all the elms have a peculiar oblique base, full and rounded upon one side, sharply wedge-shape on the other.

The three native species are readily distinguished as follows:

Inner bark mucilaginous..... .....Slippery Elm
Inner bark not mucilaginous.
Branchlets with corky wings..... .....Cork Elm
Branchlets without corky wings.....White Elm

Introduced species.—The English elm has occasionally been planted as a shade tree, although for such purposes it is less stately than our common white elm. Two European varieties have been more used for ornamental plantings, though each of them is rather curious than ornamental. These are the corky variety of the English elm, and the Camperdown or weeping elm, which is a variety of the Scotch elm. The young branches of the former are covered with conspicuous corky outgrowths, similar to those of the native cork elm, but more strongly developed. The American cork elm is distinguished from the English by its more downy bud-scales and by the production of flowers in elongated clusters (racemes), whereas those of the English elm are in close clusters. Other differences will readily be detected by those having occasion to compare the two trees. The weeping elm is usually grafted on an upright stock, leading to a peculiar umbrella-like development.

WHITE ELM (AMERICAN ELM). *Ulmus Americana* Linn.

Of all the native trees none has done more than the white elm to beautify the streets of our cities and villages, or to grace our country hillsides and meadows. The spreading vase-shaped head is its typical form, but perfect trees are only found where there has been a free development of the branches from the sapling age. Even when developing freely, however, the trees vary markedly in form. Some may be found which are very

WHITE ELM
Leaves and fruit, × ½.

strict and upright; others which are straggling and strongly weeping. The bark characters also vary much in different trees. Numerous clusters of slender, drooping flowers open before the leaves in early May, giving the tree a delicate feathery appearance. The seeds mature and fall before the leaves are fully grown.

The wood is very tough and fibrous, making it useful for ox yokes, wagon bolsters, hubs of wheels and similar purposes where there is special cross-strain.

SLIPPERY ELM (RED ELM). *Ulmus pubescens* Walt., *U. fulva* Michx.

The slippery elm is not uncommon in Vermont. The scattering trees of this species are, however, usually passed unnoticed because it so closely resembles the American elm that it is not easy to distinguish the two by general appearance. The stringy mucilaginous bark of the slippery elm is always a sure means of recognition.

SLIPPERY ELM
Leaves and fruit, × ⅓.

Other means of distinguishing it are found in its circular fruits, which appear in May; these have smooth margins, whereas those of both the other species are fringed with delicate hairs. The leaves are larger, rougher above and soft-downy beneath. But the surest and simplest test is the "slippery" bark. This has well known medicinal properties which give it a recognized value in the drug trade. The slippery elm prefers rocky ridges and hillsides.

CORK ELM (ROCK ELM). *Ulmus racemosa* Thomas.

The cork elm is a more valuable timber tree but it is found only in western Vermont and there but rarely. Its peculiarity is a growth of corky ridges which sometimes project for half an inch or more from all sides of the younger branches. The leaves resemble those of the white elm but are more conspicuously downy upon the under side along the midribs. The bud scales are also downy and the young branchlets somewhat so whereas those of the white elm are smooth. The flowers are borne in open branching clusters, or racemes, and this characteristic gives the Latin name to the species. The fruit, which matures when the leaves are half grown, is somewhat larger than that of the other elms.

HACKBERRY (NETTLETREE). *Celtis occidentalis* Linn.

The hackberry is one of the rare trees of this state, occurring so far as is known only sparingly in the river bottom lands of the Champlain valley and the southern Connecticut valley. Its berries are dark purple when ripe and may remain on the tree all winter. They are about the size of peas, with a sweet flesh which is edible, and sought by the birds. Its fine form makes it a desirable shade tree.

HACKBERRY
Leaves and fruit, × ⅓.

It so closely resembles the elms that it is easily mistaken for one of them and because of this it is doubtless frequently passed unnoticed even by botanists.

MULBERRIES.

The name mulberry is very commonly applied in Vermont to one of the wild raspberries, which has a conspicuous rose-like blossom followed by a reddish raspberry fruit. This shrub should be called the purple flowering raspberry since the true mulberries are trees. Two species of mulberry occur in Vermont; of these, the red is native, and the white is introduced.

The fruit of both is edible somewhat resembling that of the blackberry in size and appearance. The leaves are heart-shape or ovate, often cut into curiously irregular lobes so that no two leaves on a branch will be exactly alike. This irregularity in leaf-form, together with the peculiar fruit, makes the recognition of the mulberry easy. It is often difficult to distinguish the two species, however. The following key will aid in this:

Leaves bright and smooth, mostly glossy above.....White Mulberry
Leaves dull green, upper surface rough.....Red Mulberry

RED MULBERRY. *Morus rubra* Linn.

RED MULBERRY
Leaf and fruit, × ⅔.

The red mulberry was discovered at Pownal in southwestern Vermont by William Oakes some seventy years ago. W. W. Eggleston recently found a few trees near Pownal showing that it still occurs there occasionally at least. It is typically a more southern tree and this station is probably nearly at its northern limit. It becomes a tree of medium size at the south, but these Pownal plants were scarcely more than shrubs, six to fifteen feet in height. Students of trees in the southern counties should be on the lookout for it elsewhere.

WHITE MULBERRY. *Morus alba* Linn.

Some years ago there was considerable discussion and some experiments upon the feasibility of silk-worm culture in the United States. At this time the white mulberry was planted in many places in the state. These trees have proved hardy and occasionally spontaneous seedlings have appeared.

MAGNOLIA FAMILY

TULIPTREE.

Liriodendron tulipifera Linn.

The tuliptree is included in this list of native Vermont trees, although few native trees can be pointed out. The tree was authentically reported in the Appendix to Thompson's Vermont in 1853. It then occurred occasionally in Bennington county along the Hoosac river. A single native specimen of it was recently reported from North Pownal by M. Eggleston, showing that it is not yet extinct. It is to be hoped that tree lovers located in that

TULIPTREE
Leaves, flowers and fruit, × ⅓.

portion of the state will learn and more fully report upon its present distribution as this region marks its northern limit as a native tree. It thrives, however, as a shade tree planted in yards in Rutland and Burlington.

An attractive feature of this tree is its display of tulip-like flowers which open in June. The leaves are curiously four lobed, or lyre shape, as is well shown in the figure, light green above and whitish below.

LAUREL FAMILY

SASSAFRAS. *Sassafras Sassafras* (Linn.) Karst., *S. officinale* Nees.

SASSAFRAS
Leaves and young fruit, × ⅓.

The sassafras reaches its northern limit in southeastern Vermont where it occurs sparingly in sandy soils in the lower Connecticut valley. It is also found in Pownal, and should be looked for further north in western Vermont. The leaves have many interesting variations in form. Some are ovate and entire while others are deeply three lobed. These with intermediate forms may be found on the same tree. Its bright blue fruits ripen in September and are eagerly devoured by the birds. The root of this tree furnishes the sassafras bark of commerce. When transplanted it makes an interesting and rather ornamental tree.

PLANETREE FAMILY

SYCAMORE (BUTTONWOOD). *Platanus occidentalis* Linn.

The sycamore occurs sparingly in the Champlain and the lower Connecticut valleys, and their tributaries. It is also abundant in the Hoosac valley, in southwestern Vermont. It is at its northern limit in this state and as a consequence no very large trees of it occur. In the lower Ohio and Mississippi valleys, where it is more fully at home, the sycamore develops into the largest tree of eastern North America, occasionally reaching a height of 150 feet and a diameter of 15 feet.

An unmistakable character of the tree is its bark. On old trees this is brown and rough on the lower parts of the trunk, but above and on the branches it is smoother with great irregular whitish or pale yellowish patches where the outer layers have scaled off leaving the inner bark exposed.

SYCAMORE
Leaf and fruiting head, × ⅓.

This gives the tree a whitewashed appearance when seen from a short distance.

The globular heads of fruit or "buttons" swing by their slender stalks until late in winter. The wood is hard and durable for many purposes. On account of its beauty and delicacy of color it is used for furniture, and inside casings.

It is a water loving tree, preferring the low, rich banks of streams, but will grow in drier soils. It is frequently planted as a shade tree. It is interesting and sometimes picturesque, but rarely ornamental as it grows in Vermont.

ROSE FAMILY

THE MOUNTAIN ASHES

The mountain ashes are conspicuous among our trees for their broad, flat-topped clusters of creamy-white flowers followed by the persistent scarlet fruits. The common name is suggested by the general resemblance of the compound leaf to that of the ashes. In reality these trees are very closely related to the cultivated apples and pears, a fact which will become evident if one examines the structure of either the flower or the apple-like fruit.

Two species of mountain ash are natives of the elevated parts of the eastern United States and both of these occur in Vermont. They are closely related and so similar that it requires careful scrutiny to distinguish them.

Leaflets with long tapering points, leaf-buds smooth, fruit ⅙ to ¼ inch in diameter.....American Mountain Ash
Leaflets broader more bluntly and shorter pointed, leaf-buds sparingly hairy, fruit larger (⅓ inch in diameter).....Elderleaf Mountain Ash

Introduced species.—The native mountain ashes are not infrequently transplanted. The one most commonly used for ornamental purposes in Vermont, however, is the European mountain ash (*P. Aucuparia*). Plants of it are found abundantly spontaneous in groves at Burlington, evidently from seeds carried thither by birds. It is easily distinguished from either of the native species by the fact that its younger leaves are distinctly pub-

escent, with fine hairs on both surfaces, whereas the leaves of the native species are nearly or quite smooth. Both the flowers and the fruits of the European species are larger than those of the native.

There are several varieties of this or other European species in cultivation, including one that has pendulous or weeping branches, and one with leaves that are usually simple or divided only at the base, the oakleaf mountain ash.

AMERICAN MOUNTAIN ASH. *Pyrus Americana* DC.

MOUNTAIN ASHES

Leaves and fruit of the American and one leaflet of the elderleaf, × ⅓.

This is the more common native species. It is a small tree twenty-five to thirty feet high, scattered over the state but more frequent in the mountainous regions. The large flat clusters of whitish flowers open before the leaves are fully expanded. The leaf and fruit characters are well shown in the accompanying drawing. In color the fruit is bright red, and renders the trees especially conspicuous and attractive in autumn and early winter.

ELDERLEAF MOUNTAIN ASH. *Pyrus sambucifolia* Cham. & Schl.

This species is found near the summits of Mt. Mansfield, Camel's Hump, Willoughby and a few of the other higher mountains. It is not very common anywhere. This is not surprising since it is a northern tree and reaches its southern limit in New England, extending from here northward to Greenland and westward to the Rocky Mountains and Alaska. It is a small tree, or often a mere shrub when not favorably situated, with branches spreading into a rounded head. Sargent says that it reaches its best development in this region. It has been transplated occasionally in northern Vermont and has made a beautiful small shade tree.

The leaflets are seven to thirteen in number. One of them is included with the illustration of the American mountain ash that the two kinds may be compared. It will be seen that the elderleaf is shorter and broader with a tendency to be less pointed or even blunt at either end. It occurs so rarely, however, that there will be little opportunity for confusion between the two except by mountain climbers.

APPLES AND PEARS.

The cultivated apples and pears are so closely related to the mountain ashes as to be placed by most botanists in the same genus with them. They are all introduced from Europe and Asia. The apple (*Pyrus Malus*) is frequently spontaneous, and many of the best varieties under cultivation in this country came from such American seedlings. The common pear (*Pyrus communis*) and the crab apple (*Pyrus baccata*) are both near relatives of the apple. Some of the larger improved varieties of the crab are probably hybrids with the common apple.

SERVICEBERRY (SHADBUSH, JUNEBERRY). *Amelanchier Canadensis* (L.) Medic.

The shadbush is easily recognized by its graceful white flowers which appear in the most lavish profusion in May before those of any other native fruit tree. The fruits which ripen in June are a quarter of an inch long, purple, sweet and edible but the birds make way with them so quickly that they are not often to be found.

SERVICEBERRY
Leaves, flowers and fruit, × ⅓.

The shadbush is common in light soils and dry woodlands throughout the state, and especially so in parts of the Champlain valley.

It ranges in size and habit from a bush to a small tree of twenty to thirty feet. Like the other members of this family it is variable and there are also some smaller shrubby species[1] which very closely resemble it. Some of these are being cultivated for their fruits, and are said to be quite productive and desirable.

HAWTHORNS

The haws, or as they are more familiarly known, the hawthorns or thornapples, have characters which render them conspicuous and familiar to everyone. They are all small trees, often shrubby in habit, with low crowns and spreading branches. These are usually covered in spring with clusters of attractive white flowers and loaded in autumn with fruit, which is apple-like, varying in color from red to yellow and in diameter from one fourth to three fourths of an inch or more.

1 "Probably six species, as follows: *A. Botryapium*, *A. oligocarpa*, *A. alnifolia*, *A. rotundifolia*, *A. spicata*, and an undescribed species." (W. W. E.)

Several species of haw occur in this state. They are extremely variable and, indeed, are not at present fully understood by botanists. For this reason only the three most common and well marked species are included in the following key and descriptions.[1]

Branches horizontal, gray, leaves wedge-shape at base, fruit yellow or red....Dotted Haw
Branches not horizontal (irregularly ascending), reddish.
  Leaves thin, usually rounded or heart-shape at base, leaf-stalk slender, fruit coral-red.....Scarlet Haw
  Leaves thicker, shining, wedge-shape at base with leaf-tissue often extending down the short, stout leaf-stalk, fruit bright, dark red.....Longspine Haw

Introduced species.—In addition to these three species and the other native ones mentioned in the foot note, the English hawthorn (*Crataegus Oxycantha*) is often met. This has been planted as an ornamental tree and is sometimes found as an escape in woods or by roadsides. It is to be distinguished by its smaller fruit (one-fourth to one-third inch long) and distinctly cut-lobed leaves, wedge-form at the base. The flowers are large and showy.

SCARLET HAW (SCARLET-FRUITED THORN, WHITE THORN). *Crataegus coccinea* Linn.

The scarlet haws (including the various forms, see foot-note) are the commonest of our hawthorns and are certainly well known to the children of Vermont, for who has not at sometime or other eaten thorn apples or woven caps with the sharp slender thorns? The white or pinkish flowers open in early June and are among the most beautiful found upon any tree. The scarlet apples are oblong and about half an inch in diameter. They ripen in September or October and often hang upon the trees until late fall. The scarlet haws are generally distributed through the lower altitudes in Vermont.

SCARLET HAW
Leaf and fruit, × ⅓.

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1 Professor Sargent has recently made a critical examination of specimens of Vermont hawthorns sent him from various localities. Reports on these just as this is going to press indicate that a considerable revision of the botanical conception of some of the species is necessary. He distinguishes ten species among those submitted to him, as follows: *C. coccinea*, *C. macracantha*, *C. flabellata*, *C. intermedia*, *C. rotundifolia*, *C. populifolia*, *C. mollis*, *C. glandulosa*, *C. punctata*, *C. Crus-galli*. All of these except the last two are forms of what is included in Gray's Manual under *C. coccinea* and its varieties.

It is evident, therefore, that the hawthorns will present some interesting and perhaps rather puzzling questions to any one who undertakes careful observations upon them.

LONGSPINE HAW. *Crataegus macracantha* Loud., *C. coccinea macracantha* Dudley.

LONGSPINE HAW
Leaves and fruit, × ⅓.

This hawthorn is common in the Champlain valley and occurs in the Connecticut valley but is apparently less frequent in the northern part. It may therefore be expected along with the scarlet haw in most parts of the state. It closely resembles the scarlet haw in general appearance, but has spines somewhat longer, flower larger and borne in broader, stouter clusters. The fruit is rather smaller, round or compressed longitudinally. It is difficult to distinguish the species by these characters alone, however, and it will usually be necessary to appeal to the leaves in its identification. These are shining, thicker and more leathery in texture than those of the scarlet haw and have a wedge-shape base merging into a rather short stout petiole. A comparison of the figures will help make these distinctions clearer.

DOTTED HAW (SPREADING THORN, DOTTED FRUITED THORN). *Crataegus punctata* Jacq.

DOTTED HAW
Leaves and fruit, × ⅓.

The dotted haw is a curious looking tree with stout branches spreading nearly at right angles to the trunk and forming a broad flat or terraced head. This character is more clearly seen in the older trees and when viewed from a short distance. Its identification may be made more certain by comparing the form of the leaves with the accompanying figure and also by noting the fruit characters. The fruits are larger than those of the scarlet haw, sometimes nearly an inch in diameter, turning dull red or yellow in autumn and marked with whitish spots. This last character has given name to the species. The dotted haw thrives best on rocky upland pastures and is not uncommon throughout the state.

A form of this species (var. *canescens* Britton) has been found at Ferrisburg, which is densely whitish tomentose (hairy) on the lower leaf surfaces, and on the leaf and fruit stalks.

THE PLUMS AND CHERRIES

The plums and cherries, particularly when in blossom, are among the most attractive trees in New England. They are all of small or medium size with conspicuous pink or white flowers. They are distinguished by their stone fruit and by their astringent bark and leaves.

There are five species found in Vermont. One of these, the sand cherry, is a small shrub usually nearly or quite prostrate and is found but rarely. One of the other four, the choke cherry, seldom attains to the size or habit of a tree, but it is deemed best to include it in this list since it occurs so commonly along with the tree species that the omission might lead to some confusion.

Fruit red or yellow, flowers and fruit in short spreading clusters (umbel-like).
- Fruit small, ⅓ inch or less in diameter, bright red, small slender tree, bark light red-brown, leaves finely saw-toothed.....Wild Red Cherry
- Fruit large, ½ inch or more in diameter, red or yellow, small tree, branches spreading, bark rough and dark gray, leaves coarsely saw-toothed.....Canada Plum

Fruit black, flowers and fruit in long, slender clusters (racemes), bark grayish.
- Shrub, fruit very astringent, leaves sharply saw-toothed.....Choke Cherry
- Large tree, bark rough and black, fruit slightly astringent, leaves with teeth incurved.....Black Cherry

Cultivated species.—There are several species of plums and cherries in cultivation. Those oftenest found in Vermont are the following:

European or garden plum. *Prunus domestica* Linn. The common cultivated plum, including the Damsons, (the latter being var. *Damascena*). Tree strong, usually upright; leaves large, ovate or obovate, firm, thick, rough, coarsely saw-toothed.

Japanese plum. *P. triflora* Roxb. A more slender willowy tree, with smoother, greener leaves, more finely cut-toothed.

Sour cherry. *P. Cerasus* Linn. The commonest cultivated cherry in Vermont. A comparatively small tree with smooth leaves; fruit sour.

Sweet cherry. *P. Avium* Linn. A larger, straighter growing tree, seldom seen in Vermont; leaves larger, dull and soft; fruit usually sweet.

Other species sometimes cultivated are the following plums: *P. Simoni*, *P. cerasifera*, *P. Americana*, *P. augustifolia*, *P. hortulana*; the peach, *P. Persica*; and the apricot, *P. Armeniaca*.

CANADA PLUM (WILD OR HORSE PLUM). *Prunus Americana nigra* Waugh, *P. nigra* Ait., *P. Americana* Marsh. in part, according to Gray's Manual.

CANADA PLUM
Leaves, flowers and fruit, × ⅓.

The Canada plum, found frequently in Vermont, is a small tree or shrub, with grayish-brown bark and short, spiny branchlets. It may be recognized by its broad coarse leaves, sometimes four inches long and two or three inches wide. The flowers are abundant, large and strong, of a fine pinkish color, and appear about the first week in May. The fruit, often an inch in diameter, ripens in August. It is sometimes rather bitter, but occasional trees bear good eatable fruit.

WILD RED CHERRY (BIRD CHERRY). *Prunus Pennsylvanica* Linn.

The wild red cherry, a small, slender tree, is quite generally distributed from the rocky woods of Newfoundland to North Carolina. It is common in all parts of Vermont where it is often only a roadside shrub. The flowers appear in May in beautiful white clusters on long pedicels. The fruit, which ripens in midsummer, is small and globular, becoming bright red when mature. This tree is distinguished from the other cherries by its slender and more graceful form, by its lighter colored, close-growing bark, often covered with transverse scars (lenticels), by its small flowers in spreading clusters and by its very small globular fruit similarly clustered.

WILD RED CHERRY
Leaves, flowers and fruit, × ⅓.

CHOKE CHERRY (WILD CHERRY). *Prunus Virginiana* Linn.

CHOKE CHERRY
Leaves, flowers and fruit, × ¼.

The choke cherry is usually a shrub in Vermont. It is, however, included in this list of trees because of its close relationship to the other cherries. It is very widely distributed in North America, ranging from the Arctic circle to California and Texas. In May, when the leaves are half grown, it is covered with creamy white flowers in long nodding clusters. The peculiarly astringent fruit, varying greatly in quality, however, ripens abundantly in August. It makes a good quality of jelly.

BLACK CHERRY. *Prunus serotina* Ehrh.

This is the only native Vermont cherry which reaches a sufficient size to make it a valuable timber tree. It has been exported in considerable quantities from the southern part of the state, but now large trees are seldom found. The wood is of very superior quality for cabinet making, and commands the highest price of any native American timber. It has a beautiful grain and takes a very fine polish. The flowers resemble other cherry blossoms and are borne in racemes. The fruit is at first dark red, then becomes almost black, with a thick skin and dark juicy flesh, which is generally rather bitter but sometimes sweet and pleasant.

BLACK CHERRY
Leaves and fruit, × ⅓.

PULSE FAMILY

Most of the members of this family are easily recognized as such by their irregular flowers of the pea-blossom type, by their fruit pod, similar to that of the pea or bean, and by their compound leaves.

All of them which are native plants are herbaceous. Many of the species which grow further south are shrubs and trees. Several of the lat-

ter are commonly cultivated in Vermont, including four trees, the common locust, the clammy locust, the honey locust and the coffeetree.

The common locust (*Robinia Pseudacacia* Linn.) is a native of Pennsylvania and the more southern states. It has been widely planted in Vermont and has frequently run wild along fence-rows and about yards. The profusion of the fragrant white blossoms, the delicacy of the foliage and the picturesque form of the tree combine to make it very attractive. This locust is a large, rapidly growing tree. It makes the best of fence posts and it is said that it can be grown with profit for that purpose in this state.

The clammy locust (*Robinia viscosa* Vent.) is a smaller tree which is sometimes planted for shade or ornament and tends to spread. It is easily distinguished by the fact that its twigs and leaf-stalks are clammy or sticky to the touch.

The honey locust (*Gleditsia triacanthos* Linn.) is occasionally planted. It is conspicuous because of its long pods, (one foot or more) and its much branched thorns. The leaves are doubly compound.

The Kentucky coffeetree (*Gymnocladus Canadensis* Lam.) is also occasionally planted. The leaves are doubly compound and two or three feet long. The pods are five to ten inches long and one to two inches broad.

MAPLE FAMILY

MAPLES.

The maple family is a large one including nearly seventy species. Ten of these occur in the United States, and seven are found in Vermont. In many respects they form the most characteristic feature of our forest flora, and were we to select a state tree, popular choice would certainly be unanimous for the sugar maple.

The maples are easily distinguished from all other trees by their peculiar winged or "key" fruit. The leaves of all except the ash-leaved maple are also so similar as to form a good family character.

Two of the seven native species are as frequently shrubby as they are tree-like in both size and habit of growth, but all are included in this discussion. By appealing to the size of the tree and characters of the leaves it is possible to distinguish the species as follows:

Large trees.
- Leaves compound (3-7 leaflets, resembling the ash.)..... ..... Boxelder
- Leaves simple, with 3-5 prominent divisions or lobes
  - Leaves with terminal lobe more than ½ length of midrib .....Silver Maple
  - Leaves with terminal lobes ½ or less than ½ length of midrib.
    - Bottom of sinuses (i. e. larger notches or indentations) acute, lobes sharply toothed..... .....Red Maple
    - Bottom of sinuses rounded, lobes with few or no teeth.

Sinuses deep, lower surfaces of leaves smooth or with few hairs on veins.....Sugar Maple
Sinuses shallow, lower surfaces of leaves minutely hairy.....Black Maple

Small trees or shrubs.
Leaves large (often 6-8 inches long), margins finely toothed, bark light green striped with darker lines. .....Striped Maple

Leaves smaller (3-5 inches long) margins coarsely toothed, bark not striped.....Mountain Maple

Introduced species.—The Norway maple is a European species frequently used as a street shade tree farther south, and occasionally planted in Vermont. It most closely resembles the sugar maple among our native species but is easily distinguished by its broader and lower crown, larger leaves and larger, more divergent key-fruits.

Numerous horticultural varieties of the silver maple have been introduced in recent years, especially from Japan. These include very deeply cut-leaved forms, and also one with drooping branches. Their relationship to the native species is usually recognizable however.

The horse chestnuts and buckeyes are closely related to the maples, although some authorities place them in a separate family. Of these the European horse chestnut (*Aesculus Hippocastanum*) is very commonly cultivated. It forms a large, clean, symmetrical tree, with rich foliage and showy blossoms. The buckeyes of the south and west are occasionally planted.

MOUNTAIN MAPLE. *Acer spicatum* Lam.

MOUNTAIN MAPLE
Leaves and fruit, × ⅓.

The mountain maple rarely becomes more than a shrub in Vermont. It occurs commonly in moist, rocky mountain forests in all parts of the state. Like the striped maple it is partial to roadsides, and borders all our mountain driveways. The leaves are thin and downy on the under side. The greenish yellow flowers are borne in erect pubescent clusters which appear in the latter part of June. The fruits are very divergent, smaller than those of any other maple and become bright red in July and August. The heavy clusters then hang down and turn dark brown before being scattered by the winds. It is the spike-like arrangement of these flowers which suggested the Latin name of the species. This

maple is one of the most highly ornamental of the smaller trees, and worthy of more general cultivation.

STRIPED MAPLE (MOOSEWOOD, STRIPED DOGWOOD). *Acer Pennsylvanicum* Linn.

STRIPED MAPLE.
Leaf and fruit, × ⅓.

The striped maple is a small tree or shrub which forms a familiar part of the under growth of our forests, and is a common roadside bush in all parts of the state. It is easily distinguished by its greenish bark striped longitudinally with darker lines. The leaves, the largest of the maples, are usually from five to seven inches long and four or five inches wide. Its drooping clusters of greenish flowers unfold by the middle of June when the leaves are nearly grown. The fruits are abundant and turn a beautiful scarlet towards autumn. This maple rarely exceeds a height of twenty feet. It has also a distinct value for ornamental planting, especially in groups or borders.

SUGAR MAPLE (HARD MAPLE, ROCK MAPLE) *Acer barbatum* Michx., *A. saccharinum* Wang.

SUGAR MAPLE.
Leaf and fruit, × ⅓.

The sugar maple is at home everywhere in Vermont but it thrives best on the cool, rocky uplands of our state. It can be distinguished by its light gray bark which has large, white patches on the younger branches or by its broad, five-lobed leaves which have shallow, rounded sinuses. The small, inconspicuous flowers of the sugar maple appear with the leaves but the fruit does not ripen until late summer. This tree is widely distributed in North America but the fame of its sugar-bearing sap has mainly spread from Vermont.

Besides its value as a sugar tree, its timber is hard and durable. It is extensively used for flooring, also for chair stock and other furniture and for fuel. The "curled" and "bird's-eye" maple are unusual forms of this species, produced by a peculiar curling of the fibers.

BLACK MAPLE *Acer barbatum nigrum* Sarg., *Acer saccharinum nigrum* T. & G., *Acer nigrum* Michx. f.

The above list of Latin names reveals the fact that this tree has long been a puzzle to botanists. In leaf characters it differs considerably from the sugar maple, but resembles it in fruit characters, general habit and in sugar production. As indicated in the key, the leaf is less deeply lobed, and is minutely hairy on the lower face; it may also be hairy along the leaf stalk. It is thicker and more leathery in texture and is usually heart-shape at the base, the rounded basal lobes sometimes overlapping. The typical form of the leaf is shown in the accompanying figure.

BLACK MAPLE, × ⅓.

It is common in portions of Canada and farther west. In Vermont it seems to be rare, and has not been reported outside of the Champlain valley, except at Windsor. Michaux found it at the latter place about a century ago and its rediscovery there would be of a considerable botanical interest. It is usually found in low, moist places.

This black maple should not be confused with specimens of the ordinary sugar maple having darker bark. Sugar makers often term such trees "black maples." The bark of this black maple is generally dark, but the leaf characters must be appealed to in its recognition.

SILVER MAPLE (SOFT MAPLE, WHITE MAPLE, SWAMP MAPLE) *Acer saccharinum* Linn., *Acer dasycarpum* Ehrh.

The silver maple is a large, graceful tree, generally distributed along our water courses, especially near the shores of Lake Champlain and the streams emptying into it. It resembles the red maple but is distinguished

SILVER MAPLE
Leaves and fruit, × ⅓.

from it by its longer, more deeply cut, lighter green leaves which are silvery white on the lower side. Although the silver maple flourishes best in moist soil, it will make vigorous growth and become a beautiful shade tree in dry locations. It is not so hardy or long lived as either the red or the sugar maple in many situations.

The fruits are two or three inches long, larger than in either of the other species. They mature and fall in early summer.

RED MAPLE (SOFT MAPLE, SWAMP MAPLE). *Acer rubrum* Linn.

The bright scarlet flowers of this maple give us the first spring welcome from the trees. When the red maple is a blaze of color and the other trees are bare and brown, it is conspicuous and unmistakable, and in autumn the rich coloring of its leaves makes it conspicuous again. The leaves of the silver maple turn yellow and those of the sugar maple yellow or red, but not the crimson or deep red of the red maple. It is distinguished from the sugar maple by its smoother, dark gray bark and by the deeper acute incisions of the leaves although they are subject to much variation. The fruit is about one inch long and like that of silver maple falls in early summer. This tree, common throughout eastern United States, is very generally distributed in Vermont. It is especially found in low, moist soil. The red maple yields a sweet sap, inferior, however, to that of the sugar maple. The wood is rather soft with a fine smooth grain. "Curled" maple may occur in this species.

RED MAPLE
Leaf and fruit, × ⅓.

BOXELDER (ASHLEAVED MAPLE). *Acer Negundo* Linn., *Negundo aceroides* Moench.

BOXELDER
Leaves and fruit, × ⅓

The leaves of the boxelder are compound with three or five or sometimes seven slender, somewhat lobed leaflets.

In its general habit and appearance and especially in this leaf character the boxelder much resembles the ashes, hence one of its popular names. A glance at the peculiar key fruit, however, shows it is in reality one of the maples. Its flowers appear in May. The fruit becomes conspicuous by the latter part of June but clings to the tree throughout the summer and autumn.

The boxelder occurs sparingly along streams in the Champlain valley, this marking its northern limit. It is very commonly planted, but its chief recommendation for this purpose is its quick growth.

BUCKTHORN FAMILY

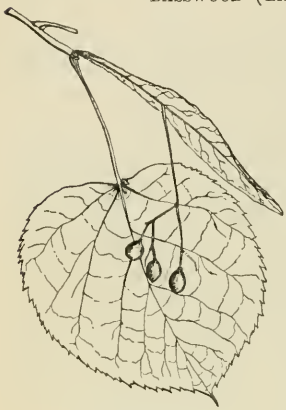
BUCKTHORN. *Rhamnus cathartica* Linn.

The buckthorn was introduced from Europe. It is commonly cultivated as a hedge plant, and occurs not infrequently as an escape. When left to itself it develops into a small and rather unsightly tree, bearing some resemblance to the wild plum. The most conspicuous character is its abundant fruit which occurs in clusters. It is berry-like with three or four seeds, one-third of an inch in diameter, and when ripe in autumn is black with green juice.

A medicinal syrup made from the berries was formerly much used. It is a powerful cathartic, and has fallen into disuse because of the violence of its action. Dyes can be made from different parts of the plant. The juice of the fresh berries yields a saffron color, and that of the bark a beautiful yellow. A fine green pigment used in water color painting under the name of sap-green is made from the berries in the early stages of ripeness.

LINDEN FAMILY

BASSWOOD (LINDEN). *Tilia Americana* Linn.



BASSWOOD
Leaf and fruit, × ⅓

The basswood is a widely scattered tree in Vermont, growing with the maples, oaks and elms. Its leaves are five or six inches long and nearly as wide, with a base more deeply cordate on one side than the other.

The flowers, which open in July, are creamy-white, borne in clusters suspended from a tongue-like leaf or bract. They are very fragrant and so full of nectar that the basswood is often called the bee-tree. The fruit ripens in autumn, forming hard, brown balls or nutlets the size of peas. These may quite thickly sprinkle the ground near the trees, and give rise to a plentiful crop of seedlings the following spring. The tough inner bark (bast) gave origin to the common name. Basswood lumber is brownish or nearly white, light but rather tough, and is extensively used for drawers and similar cabinet work, panels, inside wood-work and for toys. Owing to the fact that it is readily bent it is used also for the bodies and dash boards of carriages and sleighs.

The European linden (*T. Europea*) is occasionally cultivated. It closely resembles the American species.

DOGWOOD FAMILY

SOUR GUM (TUPELO, PEPPERIDGE). *Nyssa sylvatica* Marsh.

The sour gum is found occasionally in swamps along the shores of Lake Champlain and in the adjacent river bottoms. It also occurs in the southwestern part of the state and has been found in the interior as far north as Craftsbury (Robbins). This tree has a peculiar appearance with horizontal branches and smooth or glossy leaves, borne in beech-like sprays. Its greenish yellow flowers appear in June and are followed by the dark-blue, egg-shaped fruits, one-half of an inch long, with thin, acid flesh, ripening in October.

SOUR GUM
Leaves and staminate flower clusters, × ½.

OLIVE FAMILY

THE ASHES

The olive family takes its name from the olive tree of Asia. The only representatives among our native trees are the ashes; but several of the commonly planted ornamental shrubs, the lilacs and other syringas, and the beautiful forsythia, belong to this family.

The individual flowers of the ashes are small. But the crowded clusters in which they appear before the leaves are quite conspicuous. The flowers are of two kinds, the pollen producing and the seed bearing being on separate trees. The ashes, like the maples, have prominently winged fruits, but those of the ash hang singly whereas the maple "keys" are always in pairs.

The ashes are among the most useful of the hard wood forest trees of America, yielding to the oaks alone in value. Two species, the black and the white, occur commonly throughout the state; the red and the green ash are restricted or local in their distribution. The latter two are very similar and intermediate forms connect them so closely that some authorities rate the green as but a variety of the red. In using the the following key it is to be observed that the ash leaf is compound, that is, each leaf is divided into from seven to eleven smaller leaflets, as will be seen by examining any of the figures.

Lateral leaflets sessile (i. e., without distinct stalks).....Black Ash
Lateral leaflets with distinct stalks.

Buds, young shoots and leaf-stalks covered with fine velvety hairs....Red Ash

Buds, young shoots and leaf-stalks, smooth.

Leaves paler or downy beneath.....White Ash

Leaves smooth and bright green on both sides.....Green Ash

WHITE ASH. *Fraxinus Americana* Linn.

The white ash occurs in all parts of the state, and upon all kinds of soil, but it prefers a rich, moist location. It is an open spreading tree in the field but in the forest it sends up a clean, straight shaft with a very small head. This character helps to make thewhite ash one of the valuable timber trees of our forests. The wood is strong, tough, elastic, durable and easily worked. It is manufactured into casings, every kind of furniture, agricultural implements, and parts of carriages. It is said that in

WHITE ASH
Leaf and fruit, × ⅓.

strength and elasticity the white ash timber from Vermont is superior to that from most other sources. The white oak and the hickories are the only native trees which have a higher value for fuel. This ash is recognized by its compound leaves, about twelve inches long, with from five to nine smooth, petioled leaflets. The flowers appear before the leaves and the fruits ripen in August or September.

BLACK ASH. *Fraxinus nigra* Marsh., *F. sambucifolia* Lamarck.

The black is ash is found in lowlands or swamps. It is often called the brown ash but this name is confusing as it is also applied to the red ash. This and the white species are the commoner ash trees of the state. They are easily distinguished by the fact that the leaflets of the white ash are always distinctly stalked while the black has sessile leaflets. These are seven to eleven in number often forming a leaf twelve to sixteen inches long, which is smooth and green on both sides. Black ash timber is coarser grained than is that of white ask. It is used for furniture and inside finishings and in the manufacture of baskets.

BLACK ASH.
Leaf and fruit, × ⅓.

RED ASH. *Fraxinus Pennsylvanica* Marsh, *F. pubescens* Lamarck.

The red ash closely resembles the white ash in general appearance. It may always be recognized however, by looking closely at the buds in winter or at the young shoots or petioles in summer. These parts are velvety with delicate hairs, and it is this characteristic pubescence which suggested the Latin name of the species. The flowers and fruits bear a general resemblance to those of the white ash. The red ash is used considerably in manufactures but is inferior to the preceding species for most purposes. It is generally distributed along the shores of Lake Champlain and its adjacent waters but has not been reported from other parts of the state.

RED ASH
Leaf and fruit, × ⅓.

GREEN ASH. *Fraxinus lanceolata* Borkh., *F. viridis* Michx.

Sargent considers this a variety of the red ash which it strongly resembles. The best means of distinguishing the green ash from the red is by its smooth buds, branchlets and leaf-stalks. It takes its name, green ash, from the fact that the leaflets are bright green on both sides, whereas those of both the white and the red are paler beneath. But these characters show clearly only in decided forms and perplexing intermediate forms may be found. It is known to occur sparingly on the shores of Lake Champlain, and probably does not grow native elsewhere in the state.

GREEN ASH
Leaf and fruit, × ⅓.

BIGNONIA FAMILY

THE CATALPAS.

Catalpa or indian-bean trees are occasionally planted in Vermont, although they are not always hardy. The peculiarities of fruit and foliage give them a somewhat tropical appearance. The leaves are heart-shape and very large, six to twelve inches long; the flowers are one or two inches across and the cylindrical pods nearly a foot in length. The species most commonly planted is the hardy American catalpa (*C. speciosa*). The Japanese catalpa (*C. Kæmpferi*) is less commonly planted, but Mr. F. H. Horsford of Charlotte, who has it in cultivation, finds it to be hardy.

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REPORT

—OF THE—

Twenty-Ninth Annual Meeting

—OF THE—

VERMONT

Dairymen's Association.

1899.

EDITED BY

F. L. DAVIS, Secretary.

BURLINGTON:
FREE PRESS ASSOCIATION,
PRINTERS, BINDERS AND STATIONERS.
1899.

OFFICERS

—OF THE—

Vermont Dairymen's Association.

1899.

PRESIDENT.

G. W. PIERCE.....Brattleboro

VICE-PRESIDENTS.

M. W. CLARK.....Williston

J. J. JACKSON.....East Montpelier

SECRETARY.

F. L. DAVIS.....North Pomfret

TREASURER.

P. W. STRONG.....North Pomfret

AUDITOR.

GEORGE AITKIN.....Woodstock

An Act to Promote the Dairy Interests of Vermont.

It is hereby enacted by the General Assembly of the State of Vermont:

SECTION 1. The sum of one thousand dollars is hereby appropriated annually to the Vermont Dairymen's Association, for the purpose of promoting, developing and encouraging the dairy interests of this State.

The Auditor of Accounts is hereby directed to draw an order on the State Treasurer in favor of the Treasurer of the Vermont Dairymen's Association, for the first payment of this appropriation, on the first day of January, A. D., 1889, and annually thereafter so long as the conditions hereinafter provided shall be complied with.

SEC. 2. Said Vermont Dairymen's Association shall hold an annual meeting, continuing for at least three days, at some town or city in this State of easy access to the people, and in some comfortable and convenient building ; and said meeting shall be open and free to the people of the State. At said meeting, the best available talent in the country shall be employed to teach and discuss the best methods of dairy farming, and subjects connected therewith ; and at said annual meeting, premiums shall be offered for the best dairy products of butter and cheese, to an amount of at least two hundred dollars ; such premiums to be awarded by disinterested and expert judges, and paid by the treasurer of said Vermont Dairymen's Association.

SEC. 4. The Secretary of said Vermont Dairymen's Association shall, on or before December 1, 1889, and annually thereafter, make a detailed and itemized account to the State Auditor of Accounts of the receipts and expenses of said Association, which accounts shall be approved and countersigned by the Treasurer and Auditor of said Association.

SEC. 5. If, in any year, it shall appear to the State Auditor of Accounts that any part of the preceding annual appropriation remains unexpended, or has not been honestly or judiciously expended, then such a part or amount shall be deducted from the order for the next succeeding annual appropriation.

SEC. 6. This act shall take effect from its passage.

Approved November 19, 1888.

An Act to Provide for the Printing of the Report of the Vermont Dairymen's Association.

It is hereby enacted by the General Assembly of the State of Vermont:

SECTION 1. Section two hundred and forty-seven of the Vermont Statutes shall be amended so as to read as follows :

The Secretary (of Board of Agriculture) shall prepare on or before the 30th day of June annually, a detailed report of the proceedings of the Board with such suggestions in regard to its duties and the advancement of the interests herein specified as may seem pertinent, and he may append thereto such abstracts of the proceedings of the several agricultural societies, and farmers' clubs in the State as may be advisable and the report of the Vermont Dairymen's Association. The report shall show under separate heads the work of the Board relating to the different subjects herein mentioned.

SEC. 2. The provision of Section two hundred and fifty-one of Vermont Statutes requiring the printing of a report by the Vermont Dairymen's Association is hereby repealed.

Approved November 4, 1896.

CONSTITUTION.

SECTION 1. This organization shall be called the "Vermont Dairymen's Association."

SEC. 2. Its object shall be to improve the dairy interests of Vermont, and all subsidiary interests.

SEC. 3. This Association shall consist of such persons as shall signify their desire to become members, and pay the sum of one dollar, and a like sum annually thereafter, and of honorary and corresponding members.

SEC. 4. The payment of five dollars shall constitute a life membership, or the payment of an annual membership fee of one dollar for five consecutive years, shall constitute a life member.

SEC. 5. The officers of the Association shall be a President, two Vice-Presidents (one from each Congressional District), a Secretary, Treasurer and an Auditor, who shall constitute the Executive Committee, and have the general oversight of all the affairs of the Association.

SEC. 6. There shall be held, during each winter, an Annual Meeting, at such time and place as the Executive Committee may designate, for addresses, discussions, exhibitions, and the election of officers, who shall hold their respective offices for one year, or until their successors are chosen. Said meeting shall continue in session at least three days.

SEC. 7. It shall be the duty of the Secretary to prepare an Annual Report of the transactions of the Association for the current year, embracing such papers, original or selected, as may be approved by the Executive Committee, and cause the same to be published and distributed to the Dairymen of the State of Vermont.

SEC. 8. The Treasurer shall keep the funds of the Association and disburse them on the order of the President or Vice-President, countersigned by the Secretary, and shall make a report of the receipts and expenditures to the Annual Meeting.

SEC. 9. This constitution may be amended at any Annual Meeting by a two-thirds vote of all the members present.

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REPORT

OF THE

TWENTY-NINTH ANNUAL MEETING

OF THE

VERMONT DAIRYMEN'S ASSOCIATION,

HELD AT

ST. JOHNSBURY, JANUARY 3, 4, 5, 1899.

The meeting opened Tuesday at 10 o'clock A. M. with President Smith in the chair.

Rev. A. H. Heath invoked Divine blessing. A cordial welcome was extended to the members of the three associations combined in the meeting by Hon. A. F. Stone, president of the St. Johnsbury Board of Trade, speaking in its behalf, as well as in that of the Farmers' Mutual Creamery Company and the citizens generally. The address was responded to by Mr. M. W. Clark of Williston, first vice-president of the association.

PRESIDENT'S ADDRESS.

C. F. SMITH, Morrisville.

Members of the Vermont Dairymen's Association, Ladies and Gentlemen:

It is with pleasure that we meet again as members of this Association, to discuss questions of interest for the advancement of agriculture and dairying in our State, ever remembering that new conditions are constantly arising which demand close attention and careful study. We have been blessed with bountiful crops, and have had generally a prosperous season, on the farm and in the factory. While our cattle are chewing the cud of contentment in well filled barns, we can reap a reward for our efforts by shipping to market each week a large amount of golden butter.

In the unparalleled victories in our war with Spain, our State played a large part in national affairs. Admiral Dewey, by his skill, courage and unerring judgment, has not only immortalized his own name, but shed new lustre upon that State, which, though small in area, has always been great in achievements.

It is with pride and pleasure that I stand before you on this, the 29th anniversary of our Association, in this gem town of our Green Mountain State, a town of world-wide reputation for its manufactories, which enables the farmer to know how many *pounds* of milk or butter his favorite cow will produce, and whose goodly people have so generously provided for our pleasure and comfort while here. Our mind goes back this morning to the first meeting of this Association we ever attended. It was held in this town, opening on January 23, 1884. Col. Mead was the president and Hon. O. M. Tinkham, secretary. We were an attentive listener, but took no part in the discussions, as speaking in public was something we were too timid to attempt. We left here 3.20 P. M., with the thermometer 30 degrees below zero, and the wind blowing furiously. By taking our turn with the other passengers and trainmen shoveling snow, we reached Morrisville, a distance of 40 miles, in fourteen hours. We find, by referring to an old diary, that we attended another meeting of this Association in this town on January 19, 1887. We left Morrisville 4.30 A. M. with the thermometer 40 degrees below zero, returning the same evening. We came this year prepared for cold weather.

LEGISLATION.

This has been a year of unusual interest in our law-making bodies. We are pleased to note that the legislative committee appointed at our meeting one year ago, was successful in getting enacted a law regulating the sale of concentrated commercial feeding-stuffs. We believe this will be of material advantage to the dairymen of our State. It will be a means of education, causing farmers to study the value of protein and other nutrients and will tend to close the door to frauds and adulterations, and to keep from our markets by-products of inferior value. Some ground was also gained towards establishing confidence between creamery managers and patrons. A bill was passed providing that every piece of Babcock apparatus used for dividend making, shall be tested at our Agricultural College; and that every operator shall have a State license. The posting in every creamery, as now required by law, of the number of pounds of milk received for that month, together with the gain per cent from the churn and actual number of pounds of

butter produced from said milk and cream, should work to the advantage of all by establishing more confidence between patrons and creamery managers.

We believe, if the law had gone further and required the posting of the number of pounds of milk, and per cent of butter fat of each patron, it would cause our dairymen to test their herds, rid our State of many unprofitable cows, be a means of stimulating better feeding and better care, and put thousands of dollars in the pockets of the creamery patrons. We believe the law should also have required a uniform method of sampling and statement of account. We have a law requiring that the "basis for payment for milk at creameries shall be four per cent. fat." As there is no penalty attached, little attention is paid to it. This sometimes creates friction between adjoining creameries.

BOVINE TUBERCULOSIS.

Our laws relating to bovine tuberculosis, which are the best of any of the New England States, still stand upon our statute books, thanks to a Senate composed largely of lawyers. Our state has expended about $50,000 in the last four years in exterminating this disease. A large share of this sum has been paid to farmers as compensation for diseased cattle that have been slaughtered. It is for the interest of the State that this money be not thrown away. The work of the past four years would be largely undone if Vermont were allowed to become the dumping ground of diseased cattle from other States, as is the case with some of our neighboring States. Our herds have been cleaned up to a large extent, and if we follow the wise policy and judicious management of the past, Vermont will soon be practically free from the disease. Then the products of the dairy which is the leading industry of our State, will have a gratifying pre-eminence in the market for its known freedom from the germs of this dread disease, and our dairy stock will command a premium in the markets of other States. Far above these considerations, however, lie the safety and security of our own families.

STATE BOARD OF AGRICULTURE.

For a time the Board of Agriculture was gasping for breath. After receiving a severe pruning, we believe enough of it remains to start a healthy growth. As the temperance sentiment in the State has been strengthened by the rallying of the temperance people to oppose the high license bill, so, we believe, the Board of Agriculture will be supported by its friends, and, as a result, we shall soon have a more efficient system of insti-

tute work in our State than we have ever known in the past. If there ever was a time when we needed good institute work in Vermont it is now.

WESTERN COMPETITION.

The eastern dairyman is being hard pushed by the westerner. The same amount of feed, fed to an equally good cow, in Minnesota or Dakota will make as many pounds of butter as it would if fed in Vermont. While feeds are from two to three times as high here as there, their butter can be placed upon New York market at less than one cent a pound for transportation in excess of ours. A few years ago but little butter was made in Minnesota. Last year she produced over 50,000,000 pounds of butter and 5,000,000 pounds of cheese. Nearly two and one half million dollars worth of butter and cheese were sold in South Dakota. New creameries are constantly being built in these and other western States. We need the institute workers to teach us how to stop the wastes upon our farms, and how to make our dairy products at a less cost. We should grow all the starch element, or carbohydrates, we need at home. When we can raise 5,000 pounds of starch in an acre of corn and preserve it almost without waste in the silo, in a palatable form, why buy western corn and pay the freight? We can buy feeds rich in protein, like linseed or cotton-seed meals, to balance our rations, nearly as cheaply as can the western dairyman. With proper care in saving the plant food, we can feed our dairies and our soil with the same dollar. We can also save large phosphate bills by not allowing any plant food to go to waste about our buildings. We may also call to our aid a little plant that is not only rich in protein but has the power of storing a large amount of nitrogen in the soil, that most valuable of all Vermont crops, selected by the women of our State at the Legislature of 1894 to be the State flower—the *clover*.

We can no longer keep unprofitable cows for the pleasure of their company. It is by studying and working along these lines that we must expect to meet competition, ever remembering that westerners too are constantly progressing. We believe there is reward for the dairyman in Vermont, if he is painstaking, hopeful and thoughtful. His success depends almost wholly upon the intelligence with which he directs his labors.

OLEOMARGARINE.

Another serious problem for us to consider is the fraudulent butter made in Chicago and other western cities. Decisions have been made by the United States supreme court, in the past

year, that the oleomargarine laws in several states were unconstitutional. We should be thankful, however, that all of our supreme judges do not agree in these decisions. A few weeks ago we were visiting an old schoolmate, who is now a retail butter dealer in Chicago. He, being a Vermonter, was much opposed to dealing in a fraudulent article, and up to two years ago, his firm sold only genuine butter. But it could not meet the competition. Its trade gradually grew less, and it became evident that they must either take out a government license and sell oleo or go out of the business. They chose the former alternative and from that time on their trade and profit increased. They now sell more than nine pounds of oleo to one pound of genuine butter. While the laws of Illinois require that "each sale shall be accompanied by notice to the purchaser that the substance is imitation butter," no man in their employ is ever allowed to even whisper a word as to its character, although many of their customers know it is not genuine butter. My friend told me of a man who, a few years ago, was at work by the week driving a delivery wagon. Seeing the enormous profits that were derived from the business, and being a shrewd fellow, he began the manufacture of imitation butter on a small scale. To-day he is worth many millions. During the last fiscal year the government license was paid on 2,000,000 pounds more than during the previous year. If we could get a national law requiring all imitation butter to be colored pink it would practically stop its sale. If this cannot be done, the internal revenue tax of two cents a pound should be raised sufficiently to protect the farmer, and to prevent such enormous profits to manufacturers and dealers. Thanks to the inadequacy of present laws Vermont butter is manufactured in Massachusetts and Rhode Island, and large amounts of Vermont maple sugar in Chicago.

OUR NEW POSSESSIONS.

Among the new problems that have arisen since the last meeting of our Association, one of interest to the farmer is, what is going to be done with our new possessions. Are they to be admitted to the Union as territories? This is demanded by Spanish property holders in these islands, and it will be supported by powerful monopolies in this country, who will wish to utilize the cheap labor and great productiveness of these islands, to supply our markets duty free. They would not only ruin our beet sugar, tobacco, fruit and other domestic industries, but would lessen our United States revenue $100,000,000 or more annually. This would make our taxes, which will be largely increased to support a large army and navy, and

to pay our war debt, fall heavily upon the American farmer. So long as they are sure of such enormous profits, these monopolies will bring so powerful a pressure upon our representatives in Congress that weak human nature can scarce withstand it.

The old saying that "money is power" should be changed to money is becoming more powerful. While our dairy interests would not be as directly affected as some other branches of agriculture, yet what injures one hurts the whole.

FOREIGN MARKETS.

The Department of Agriculture at Washington has demonstrated that we can find a market in other countries for our surplus butter. Would it not be better if more of it was shipped away when our markets are low, not allowing so much to accumulate in cold storage? We must learn to cater to this market, and try to establish a good reputation for our dairy products by sending only such as their trade demands. We need not be afraid of an over-production of high-grade dairy products. The better the quality the larger the consumption of both butter and cheese. With the increased information we are hoping to receive from this meeting, and from a closer study of our business, let us take courage for the future.

EDUCATION.

The profits we shall receive and the value we are to society will depend largely on the books and papers we read and study, the mind and character we develop, the character and condition to which we bring our soil, and the character and condition of the animal life on our farms. The soil as well as the animal life on the farm will improve or deteriorate in proportion to the intelligent ideas of the farmer in charge. Dairy farming, or the production of cheaper milk, calls for constant study along the lines of breeding the dairy cow, soil management, economical feeding rations, and the weeding out of those cows of the lower grades. The farmer of the future must be an educated man. It is as essential that his mind be trained to close study as for the manufacturer or lawyer. A trained mind can see and knows how to act. But let us educate our boys towards the farm, not away from it. Never, in the history of the world, could so much valuable information be gained for so little money as to-day. Books and periodicals of all kinds, reading courses for farmers, our dairy schools and short courses in agriculture, will make any boy, with a fair common school education, see new possibilities, and start him on the road to be a thinking, successful

farmer. Where possible our boys should take a full agricultural course. On the farm is a good place to be born, a good place to grow up, a good place to enjoy life, and a good place to die in peace and plenty when we have reached the golden age, surrounded by our children and grandchildren. Eighty per cent of the business men of our cities are born on the farm. Many of these men are now seeking homes in the country. Farmers as a rule are becoming better satisfied with their business, and have less desire for city life with its worry, confusion and entanglements. Farmers should and could with a small expense make their homes more attractive by beautifying their surroundings. Walks, well laid out grounds, trees, shrubs and flowers bring a new value to the farm, and make it an ideal home. Better roads and better schools are demanded.

With the advent of the electric car, free rural mail delivery, telephone connections, acetylene gas for lighting houses and barns, and all other modern conveniences, together with its air and sunshine, birds of song and animal pets, living close to Nature's God, a home in the country will be more desirable than the residence of the city millionaire.

PRIVATE DAIRYING.

G. C. Wright, Walpole, N. H.

I come before you with a very small paper to-day, and with a theme which has been discussed since the time of Adam by more able and distinguished men than I. A great deal might be said about the question of co-operative work, but I will touch to-day only on the lines of private work in New England, the same old way our fathers trod. Many of these gentlemen and ladies before me are pretty well acquainted with dairying, private dairying at home ; many gain from it their living.

There has been a great deal of concentration in every department of business life, the aim being to get the masses together, and to bring about changes which would be of mutual advantage. And thus the dairymen of Vermont come together from all over the State and by their meetings and exchange of ideas, keep up with the times.

The co-operative and proprietory creameries are largely supplanting the private dairying interests. Creameries are a great benefit both to the producer and to the consumer. Yet fresh, sweet dairy butter always has a market. Co-operative industry does a great deal of good and I wish to give it its proper and just due. Still the question arises in every thoughtful mind, have we been fair to the interests of private dairying, have we done well in every instance in abandoning private dairying and joining with others. This is the question—what is the best thing for us and for you ? Shall we run private dairies ? Many are in co-operative work. Each must solve the problem for himself. We wish to bring out ideas in regard to it in the discussion that may follow.

Several conditions enter into the success of private dairying—the man, the surroundings, the labor, etc. The greatest factor entering into the manufacture of dairy butter, is the man himself. I think it requires adaptability to run this home industry, just as in teaching music. The musician must have an intuitive sensitiveness for music to be successful. Similarly the good butter-maker must be inspired with the appreciation of that special article, butter. He has got to know how to make the butter, to know by instinct, to have an appreciation

of the art; to know the whole line and history of the breeding, the feed, and treatment of the cow, and the handling of the milk and cream, as well as of the little globules of butter. The moment the man comes into the spirit of it and enters into and loves his work, he begins to appreciate the conditions needed to carry it out successfully. How often has the work been done by the mother, by the wife; sometimes by father or husband? More and more it ought to be done by father, husband and son.

Next to consider in this matter of butter making, of dairying in any form, is the margin of profit. If that margin grows smaller, there are reasons for it which we should strive to fathom and overcome. Does competition put the margin on the wrong side or does it keep it on the right side? If we can figure out that there is a margin on the right side of this home industry, it is worth consideration. The man who makes his butter at home can give it more careful attention and closer observation than can be the case at the creamery, and can get a little more in butter. And there is always a demand for nice dairy butter. There is something about the old fashioned dairy butter that makes many housekeepers love to have it on their tables. If you have the right kind of home made butter, there will be a little margin above the price of average creamery butter. There is another little margin in favor of this home industry; if the conditions are right the butter can be made at home for less than you pay the creamery man for making it. The time you take to carry the milk to the creamery is longer than it would take to make the butter. Given the right man under the right conditions, he can save by making his butter at home. I am always in favor of the creamery for the man who makes poor goods.

There has never been a surplus of gilt-edged butter in the market, and whenever we have a superior article of fresh, sweet dairy butter, there is a demand for it. The table keeps pace with the supply. And so I claim that there is a future for this home industry, private dairying. I believe that we, who are in the business and satisfied with it, ought to stay right with it. There is much satisfaction in having a business of one's own, and most farmers enjoy running their own business in their own way.

If we believe we can and are able to do the work, we can build up this home industry. By doing our best in every way we better the position of the products of private dairying in the market of the future. I believe more and more that private dairying is the best dairying and of the largest interest, and that more and more interest is shown in it by those who are aking it up.

HOW CAN CREAMERIES PRODUCE GILT EDGED BUTTER THAT WILL PRODUCE THE HIGHEST MARKET PRICE?

JOHN E. GALE, Guilford.

The product of the co-operative creamery is of a most composite nature. In considering all the elements which enter into the various processes of production, manufacture and marketing, we must give our attention to that minuteness of detail, that thoroughness of operation which should be observed at every point from the pasture, hay-mow and grain box to the delivery of the butter to the customer, in order that the finished product may possess those delicate and desirable qualities of pre-eminent superiority which distinguish gilt edged butter from that known as of "good" or "prime quality."

The butter question is of such momentous imporance to the dairymen of Vermont, the competition of our fellow farmers of the south and west has attained such vast proportions, and they are able to make goods at so much lower cost, that it leaves us but one practical resource, to produce the best article that can be made, and market it in the best possible condition.

The pure water and excellent pasturage of Vermont give our dairymen an advantage over their competitors which cannot be over-estimated, while close proximity to the great New England markets enables us to deliver our dairy products in large or small quantities in the best of condition. We have every facility for placing upon the market the best quality of butter that it is possible to produce.

Within the past few years the application of advanced scientific methods and the general use of modern dairy apparatus has tended to multiply greatly the number of butter-making institutions in all parts of this country. The great increase of production without a proportionate increase of demand has been mainly responsible for the low prices of the past few years.

The quality of butter is more variable than that of almost any other food product, and a strictly first class article is always appreciated by the general public. Gilt edged butter cannot be made from inferior cream, neither can first class cream be produced from tainted milk; hence in considering this subject we naturally begin with

THE COW, HER FOOD AND CARE.

While individual cows of any breed may possess exceptional merit, yet it seems to be well established that the Jersey and Guernsey stock have a characteristic power of imparting a superior color, grain and flavor to the butter. Their butter-fat globules are larger than those of any other breed, consequently the gravity separation of their cream from the milk is more rapid as well as more thorough, the cream is more quickly churned and the butter of better grain.

The butter produced by cows well fed and cared for will be of better color, texture and flavor than that from cows otherwise handled.

Bran, mixed feed and middlings make a smaller fat globule, which not only produces finer grained butter, but does not separate from the milk in the form of cream as readily as the fat from the heavier grains.

Gluten meal produces softer butter than corn or cotton seed meal, and although it is well adapted for winter feeding, it should not be fed in warm weather, when butter must be firm if it is to be rated as gilt-edged.

Sour ensilage, musty and mouldy hay, fodder or grain must be carefully avoided, for no amount of subsequent care can counteract their evil effects.

Feed well; feed liberally; give your cows all they will eat; that is the express purpose for which you keep them. They are only machines for converting rough produce, averaging $16 per ton into butter, a concentrated product worth $500 per ton.

DAIRY SANITATION.

Have regard always for the health and comfort of the animals. Do not let them lie upon a cold, damp floor, nor leave a door or window open with a cold wind blowing upon them.

Remember that ice water is just as cold in January as it is in July, and that water can be warmed with wood at $3 per cord cheaper than it can with hay and grain at Vermont prices; $5 per cow for the winter would be a low estimate of the value of warmed water over that of ice water.

Clean, healthy, well fed cows are indispensable to the accomplishment of our purpose. Gilt edged butter cannot be made from milk produced in close, ill ventilated stables, nor from the milk of ill-fed or diseased cows. The utmost cleanliness must be observed throughout the whole conduct of our business. Let every patron keep his cows and his stables clean.

Never use a wooden milk pail and never use your milk pails for anything else. Keep pails, strainers, cans and creamery tanks clean, and the separator room free from foul odors.

Great care should be exercised in cleaning the separator. This cannot be properly done by running water through it. Use the brush freely, clean promptly, as it is difficult to remove dried milk. Rinse out with cold water before the utensils are scalded, otherwise the albumen of the milk will be coagulated by the heat, when it will adhere strongly, and its removal will be difficult.

Clean the milk pails thoroughly, for otherwise bacteria will be propagated in the angles and seams, and no amount of straining can take out bacteria, or the taints caused by them, neither can they be removed by the separator.

The separator *must be kept* in a clean room, not in a stable, nor in any place where the air is not pure at all times. Always have two cans for cream if a separator is used, so that warm cream is never turned in with cold cream.

If the Cooley creamer or other submerged can process is used see that the tank is kept clean; it will require an occasional brushing out and cleaning with sal-soda, no matter how pure the water may seem to be.

Use plenty of ice; the cream must be kept cold. Always keep the cream under water. Do not expect the gatherer to take it if it is sour. Mixed cream in all stages of maturity makes anything but gilt-edged butter.

Let every patron understand the importance of this point; this is the most difficult problem that the creamery management has to deal with.

Remember that this is *your* business, your own; that every point which you can raise the marking upon your score card has a cash value to you, and remember also that no butter maker, no matter how expert he may be, has any method of producing gilt-edged flavor from tainted cream.

BUTTER MAKING.

The trips of the gatherer should be frequent enough to insure delivery at the creamery in prime condition. His cans should be covered with a clean canvas in hot weather, to protect them from the sun and dust, and to keep the cream from freezing in cold weather. His scales and weighing pail should be kept clean and away from the dust, not thrown carelessly upon the wagon seat.

A heavy portion of the responsibility for the product of the creamery rests upon the butter maker. Carelessness and gilt edged butter do not characterize the same institution.

If the cream is allowed to ripen too long the flavor as well as the keeping qualities of the butter are impaired, and if churned too soon the flavor is apt to be lacking and there is greater likelihood of a loss of quantity. If churned at too low a temperature the buttermilk does not work out well and the product will be inferior; and if too warm, the butter will be too soft and the grain spoiled.

Wash the butter well, and see that the water and buttermilk are thoroughly worked out.

Use good salt. There are many good brands, but some kinds have a tendency to "work out" to the outside of the butter and should be avoided.

See that the tubs are packed solid, and that butter is never put into a dry tub, nor one that is not perfectly clean.

Place a neat, round piece of parchment paper of sufficient size over the top of the butter, and see that the covers are firmly fastened on.

Have a print mould of the right size to hold exactly even weight, and see that the butter is well pressed in so that it will be firm and solid.

Wrap each print carefully in good parchment paper and set it away to cool in the refrigerator before packing in the cases.

Keep the refrigerator cold and clean. See that it is used for butter storage and for nothing else.

Keep the butter making and storage rooms free from dirt, smoke and unwholesome odors of every description. Don't allow a fly or a cat to come inside the doors. Keep the air fresh and pure at all times. Keep all the machinery, utensils and surroundings clean and tidy; then if customers drop in unexpectedly they go away favorably impressed.

CREAMERY MANAGEMENT.

The general management of the enterprise should be vested in some competent person aside from the butter maker, some one who is interested in the business, who will be constantly alert to produce the best article at the lowest cost of production.

He will have charge of the furnishing of supplies, and will always buy the best of everything: salt, color, paper and tubs. The finest of butter, packed in inferior tubs or packages, does not command the highest market price. Appearances go a great way with the purchaser, and particularly so with the buyer of food products. Do not ship in grimy, battered cases, with rusty hinges and hasps, no matter how clean the inside may be. Provide new shipping cases when needed,

and have them all, old and new, neatly painted outside as often as appearances require.

Every crate, tub or package of butter should bear a distinctive mark which will serve as a guaranty of its contents, and indicate that the producer is proud of his product. Let the brand carry with it the stamp of superiority in all its details and presently your efforts will be recognized, and when the demand exceeds the supply you will be able to name your own price.

Make the product as uniform as possible in quantity and in quality. Cater to the best trade. The markets are always well supplied with good butter, but there is very little to be had whichis really gilt-edged.

Keep up your reputation at home. Let the appearance of the buildings, grounds and teams denote the respectability and success of the institution.

Do not be wanting in vigilance. Keep watch of the gatherers. If they are paid according to the quantity collected they are apt to accept anything that is offered, and one can of thick, sour cream will rub the gilt-edge off of a whole churning.

Inspect the cream routes occasionally. Know whether the patrons are supplying the conditions essential for the manufacture of a strictly first class article.

Interest every patron ; teach him the importance of details, that to be successful a co-operative creamery must be such in fact and not in name only ; lead him to exercise the same care as though he made his own butter and sold it for forty cents a pound.

Enforce the rules. One or two patrons may need dropping from the route, but the number will be few, and these few must not be allowed to jeopardize the interests of the many, for it must be borne in mind that the creamery is a business enterprise, and not a charitable institution.

DISCUSSION.

Secretary Pierce. Will Mr. Gale state his opinion of the best methods of handling those persons who do not come up to the mark—who do not produce good healthy cream. Will he give us some explanation of the method of bringing them up to the standard?

Answer—That matter has always been a difficult one for the creamery to handle. It is hard for the creamery man to deal with it. He has to be careful in handling such patrons. If he finds them furnishing cream not properly cared for, he should closely examine into the condition of things, and especially the meth-

ods, the premises, the cows, etc. If he finds the methods and conditions wrong, he should talk carefully and reasonably to the patron, explaining wherein he ought to do differently. Let him understand you expect he will correct his methods. Interest the gatherers in the necessity of carefully watching. If not righted, notify again. After a second notice, we make another examination. If the instructions not complied with and we find the patron has not conformed to the conditions, we tell him that they must be complied with, that he must conform to the rules. We so far have had occasion to drop but two or three patrons. Some do not put up enough ice to carry them through the summer and during the latter part of August to September and first part of October we are apt to get some sour cream. We instruct the gatherers not to accept any sour cream, or any not according to the rules. Some times we have been obliged to accept sour cream. The sour cream problem is the hardest one we have to deal with. We have to instruct the persons to put in ice enough another season to carry them through.

Member. Will you tell us about submerging the cream in water. Do all your patrons have to do this?

Answer—We have decided to make a new rule to cover that point. It has not been done but we are considering it carefully and are going to do it.

Question—Would that imply that every patron must use the Cooley creamer or submerge the cream under water, in a spring, well or somewhere?

Answer—The farmer may use whatever arrangements he has for that purpose. Most have zinc-lined tanks made; any arrangement to keep the milk completely under water will do. They ought to have it submerged in pure water. It will entail a good deal of expense to the patron, but it is worth the cost.

Mr. Campbell. You advised the use of the best salt. I would like to inquire what kind you consider to be the best salt?

Answer—Well, I do not want to undertake to say which is the best salt. I have used the Worcester for two years.

Mr. Kneeland. I would like to ask Mr. Gale if he considers that better butter is made by the deep-setting creamery or similar methods than by the separator?

Answer—A great many use separators, some one process, some another. I cannot say.

Member. I think the separator makes better butter than the Cooley creamer, as it takes out impurities.

Answer—If there are any impurities in milk, of course, the more thoroughly they are taken out the better the butter will be. Impurities from foreign matter we do not expect to find in milk. I will admit that the separator does remove impurities better than does the Cooley creamer.

Mr. Pierce. I find that the separator produces fine butter that scores higher.

Member. As a rule it scores higher than does that made by any other process.

Secretary Pierce. Mr. Chairman—You remember that several years ago Hon. Z. A. Gilbert of Maine gave us a paper on creamery management, in which he stated that the Cooley system was superior to any then in use. He was one of the butter judges at that meeting and nearly every time he placed the first prize on the separator butter and came before us and took back what he had said. The judges placed the prizes on separator butter more times than on that made from deep setting.

Member. I would like to ask Mr. Wright if he believe private dairying pays to-day ?

Mr. Wright. I believe that there is as large a margin in private dairying as in any form of dairying to-day. We know that the margins are small, that it doesn't pay as it ought to. Yet many intelligent farmers are to-day following private dairying and are getting a little larger margin than when they put the cream into a co-operative creamery.

Question—Do you think it pays the farmer to patronize a creamery ?

Answer—I do not believe, as the times are now and considering the high price of labor, that it pays to make butter at home. If you have a family that can do it, and the labor doesn't cost you anything, or not very much, possibly you might make it pay to make the butter at home. If you have to hire help I do not believe it pays to make the butter consumed on your own table. I should buy it.

Question—If you are going to buy butter for your own family, would you get it from a dairy ?

Answer—It depends on circumstances. I should not care to eat the make of some creameries, but would that of others.

Question—Isn't it a fact that dairy butter keeps sweet longer than creamery.

Answer—Good butter never keeps long.

A Member. I have been making dairy butter and sending it to the Boston market every week for many years. I never took a pint of milk to the creamery yet. I employ help indoors and out and the part I save by making the butter instead of taking it to the creamery pays the bill.

Secretary Pierce. First-class butter, no matter of what kind, either dairy or creamery, commands a fancy price.

Mr. Harvey. This seems to be of vital importance, making our butter in the home or in the factory. We used, twenty or thirty years ago, to make it in the home and got a good price for it, getting forty cents during the fall of the year. I took it to the

factory and realized less for it. I began to obtain less for dairy butter. We send our milk to the factory and every month get a check which almost pays the meal bill.

Mr. Choate. I was persuaded to put my milk into the creamery. I told them I would deliver it one year and did so. When I got through, I figured up, and never had done so poorly. I was satisfied that taking milk to the creamery is not the way for a man, especially a young man, to pay a mortgage. If a man cannot make good butter, he had better carry the milk to the creamery. If he can make good butter, he should keep the milk at home.

President Smith. I would like to ask how much it costs to make butter at home. I would like to hear expressions from a number. I heard a statement made at a Dairymen's meeting two years ago that it would cost eight cents a pound to make butter at home, and I made the statement that I believed it could be made at home for two cents a pound.

Mr. Kennerson. I have made butter for a number of years. The last few years I have let my boys make it. They finally took it to the creamery, and in a short time found that they couldn't afford it, that they were losing money. It often takes more time to go to the creamery than to make the butter. If one lives close to the creamery, of course, one can save this.

Mr. Barrows. I am strongly in favor of the creamery. We started a creamery in Coventry the 20th day of June. The creamery furnishes everything, and gets the butter ready for the market. There is no expense to the farmer, and it costs him to make this butter less than two cents per pound. If there is anyone who thinks he can make it for less than two cents per pound, I would like to know it.

Member. I don't think it costs me one cent.

Mr. Wright. It costs about five cents to manufacture but-from actual figures. I know whereof I speak, for I made butter in a creamery for some years. When our creamery started they did not have much cream. They had to urge farmers to get them to bring their cream. Now don't you think I could make butter for five cents per pound? To-day they are charging five cents per pound for making butter.

Mr. Underwood. I am managing a creamery in this place. I would say that I think for the last year it has cost us a fraction under three cents per pound, which includes separators. There are one or two points made in the paper and in the discussion upon which I wish to dwell for a minute. If the farmer has conveniences, he can make his butter as well as take it to the creamery, if he has a good market. Probably there is no creamery in existence that can do better than the private dairy. You may think this is a queer statement for me to make,

but the majority of farmers, I venture to say, who make their own butter are obliged to get what they can at store pay. This affects the price. He will take what he has in store for payment or getting an order on some other store, the merchant there getting his profit, and the farmer gets his goods. This is carried on to a great extent. Such farmers benefit by sending their product to the creamery.

I have noticed since the creamery came into general use that the farmer's buildings are kept better. He gets his check every month and depends upon it to meet various demands when he couldn't otherwise keep up a look of prosperity. Where a man has a special market it will usually pay him better than patronizing a creamery. If he has not a good market it is better to go to a good creamery—if he can find one.

Secretary Pierce. I believe that the best, highest scoring butter is made in the private dairy. I believe, however, that that we can make just as good butter in the creamery as in the dairy. Gilt-edged butter commands a high market price.

Mrs. Nelson. I have hardly got my books figured up for the year to know what I have done. As near as I could tell the grain for the cows cost about fifteen dollars per head. My butter averaged me per pound twenty-one cents net. I presume some creameries pay more than that. I help to do my milking, and to manufacture butter at home ; I can do it as well as not with what help I have.

Member. We churn twice a week, one hundred or one hundred and fifty pounds on each churning day. It takes from five to seven hours, and costs about a cent or a cent and a half a pound. I doubt if I could get that much for the same hours for any other work on the farm I do. We separate in the barn.

Mr. Gale. In regard to the comparative cost of butter-making at home and at the creamery, I think that it depends a great deal upon circumstances. It costs us to make butter less than three cents per pound, which includes everything. The farmer has the check returned to him. It costs less than three cents, about two and three-quarters ; and I doubt whether many private individuals can make it at a less cost. There may be cases where it can be produced at less cost and more can be realized if it is made by the farmer than when it is made by the creamery, but it isn't always convenient for the farmer to make his own butter. The creamery ought to be able to make it at a lower cost than can the individual. If the latter has his private customers he gets enough more than the difference in the cost of the production.

Mr. Currier. I would like to ask a question I have never heard asked in a dairymen's meeting. Has any dairyman here ever used sugar with salt in making butter? I have made butter

for thirty years and take premiums, and use granulated sugar in butter. I think the butter is better every way for it.

Member. I have made butter for many years and have used a little white sugar. To twenty or thirty pounds I put in a teaspoonful.

Secretary Pierce. Don't you call that adulterated butter?

Mr. Tinkham. I know a most successful dairymen who puts in a little sugar in making butter. Now just a word about dairy butter. I think it depends a great deal on the circumstances about dairy butter. The farmer can make a better article than the creamery, for the reason that the farmer has every condition under his control. The creamery man has got to take it as it comes.

Member. Is butter made in a private dairy by the separator, creamery butter?

Answer—I have had that question asked many times and taken some pains to get a solution. If a dairyman makes his own butter it is dairy butter whether he makes it by the separator or another way. If he unites with the milk or cream from his own herd that made by other cows, the place thereupon becomes a creamery. If he makes his butter in his own home, that is dairy butter.

G. W. Humphrey. I have a dairy of twenty cows and have made my own butter for forty years. I never made any butter in my life but that I put in sugar, and I have taken premiums.

Mr. Kneeland. Cannot we separate in the barn and make as nice butter as though we separated in the dairy-room at the house?

Mr. Smith. I will add my testimony with relation to sweetening butter with sugar. My father, years ago when I was a boy, always put in a little granulated sugar. I did so. But I once sent some butter to a different party and he suspected that I had put in some sugar. It didn't all work out. He wrote—"Please don't put any more sugar in your butter." In my judgment if the butter is as perfect as it should be, it cannot be improved by putting in sugar. The addition of sugar may cover up something. Speaking of having the separator in the barn. Eight years ago we bought a separator and made a small room at the end of the stable and put the separator in there. It saves carrying the milk to the house, and I don't believe it affects the butter in the least.

Member. It seems that the fact of the cream being in the same atmosphere the cows breathe must affect the quality of the butter. The air ought to be perfectly pure, and letting that stream of cream run through an impure atmosphere must affect the quality of the cream. It seems to me that it might be

safe in some cases but that with a great mass of farmers it would be dangerous. I wouldn't do it at all.

Member. I had a separator in the stable a short time and don't believe it was any detriment to the quality of the product. I do not practice putting sugar in butter. The best butter I have seen on exhibition was sweetened; yet I don't believe it would do to sweeten butter which is destined for cold storage.

Member. I have had a separator in the stable for four years and have never detected any bad effects from it. I am well acquainted with a butter maker who when the cream is a little over sour puts in a little sugar and thinks it does good.

Mr. Wright. The matter of sugar or no sugar is simply a matter of consumer's tastes. Some like it, others do not. In order to make butter most profitably, we have got to consider just what our customer wants. We want to satisfy our trade.

Member. I have been sending butter to the same concern for twenty years. If you make a good article and send regularly to the same party, they will get customers for your butter.

Member. I think the last gentleman has struck the keynote. I think we try too much to sell here, there and everywhere. I sell my butter to one man, and he is always glad to have a good article. We want to keep trying to get a better article so people will want it. I think we miss very much in running around trying to get higher prices. The thing to do is to make a better article and carry it to the same place and we will get a higher price.

Pres. Smith. My idea is that good butter can be made by any method. As good butter can be made and has been made by one method as by another.

CATTLE FOODS.

DR. J. B. LINDSEY, Chemist, Mass. Agl. Exp. Station, Amherst, Mass.

Gentlemen of The Vermont Dairymen's Association :

I desire to talk with you in a very informal way concerning some of the more important cattle foods which can be utilized by the farmer for the economical production of dairy products.

As feeders we deal with two great classes of feed stuffs, the coarse feeds and the concentrated feeds.

A. OF WHAT ARE CATTLE FOODS COMPOSED.

All cattle foods, either concentrated or coarse, are made up of six groups of substances : Water, ash, cellulose or fiber, fat, protein and non-nitrogenous extract matter.

Water. The green coarse fodders contain 60 to 80 per cent of water, the dry fodders from 12 to 20 per cent, and the concentrated feeds, as found in our markets, from 8 to 15 per cent.

Crude Ash represents the mineral ingredients of the feed. It will remain behind as ashes, should the feed be burned. These ashes consist of lime, potash, soda, iron, phosphoric acid and sulphuric acid.

Crude Cellulose or Fiber is the coarse or woody part of the plant. It may be called the plant's framework. It is present as a rule only to a limited extent in the grains and by-products.

Crude Fat includes not only the various fats and oils found in different feed stuffs, but also waxes, resins and coloring matters. It is sometimes termed ether-extract, because it represents that portion of the plant soluble in ether. Fat found in grains and seeds is comparatively free from foreign substances (waxes, resins, etc.)

Crude Protein is the general name for all the nitrogenous matters of the seed. It corresponds to the lean meat in the animal, and may be termed "vegetable meat". It has the same elementary composition as animal flesh, and is considered the most valuable part of concentrated feeds.

Non-nitrogenous Extract Matter consists of sugars, starch, gums, etc. The grains are very rich in starch and similar substances.

Carbohydrates. The fiber and extract matter have the same functions in the process of nutrition, and collectively they are termed carbohydrates.

In considering the groups of nutrients going to make up the various feed stuffs, we leave out of consideration the water and the ash—the latter being present in more than sufficient quantities—and confine ourselves to three great groups of nutrients, the *protein*, the *fat*, and the *carbohydrates*.

B. USES OF THESE GROUPS.

The protein in all feeds is the only source of lean meat in animals, and the exclusive source of casein or curd in the milk. It is also a source of heat and energy in the animal body. It is possibly a source of animal fat.

The fat of the feed is a source of animal fat, and a source of heat and energy.

The carbohydrates or starchy materials are the great source of heat and energy.

Aside from the question of palatability, which is always an important one in feeding animals, the problems for us as feeders are; first, how most economically to secure these several groups of nutrients; and, second, the correct proportions in which to feed them in order to obtain the most desirable results.

In beginning a consideration of these problems, it will be wise for us to attempt a general arrangement or classification of all ordinary feed stuffs.

C. CLASSIFICATION.

COARSE FEEDS.				CONCENTRATED FEEDS.	
Class I.	Class II.	Class III.	Class IV.	Class V.	Class VI.
Low in protein, high in carbohydrates. 85 to 95% digestible.	Low in protein, high in carbohydrates. 65% digestible.	Low in protein, high in carbohydrates. 50 to 60% digestible.	Medium protein, medium carbohydrates. 50-60% digestible.	Low protein high carbohydrates. 80 to 90% digestible.	High protein, medium carbohydrates. 80 to 90% digestible.
Carrots, beets, mangolds, potatoes, and turnips.	Corn ensilage from stalks and ears, and early cut green fodder.	Hays, corn, stover and straws.	Clovers, vetches, pea and soy bean fodder and bran.	Corn, wheat, rye, barley, oats, hominy, meal, etc	Cotton and linseed meals gluten meals and feeds, brewers' grains, malt sprouts.

The above arrangement makes it clear that the coarse feeds have been divided into four, and the concentrated feeds into two classes. It is not my purpose to consider Class I at length. This class consists of the various root crops. When used in moderate quantities they are very desirable feeds, but in my judgment they are as a rule too costly for the dairyman to grow.

As *types* of the other five classes we may note the composition of hay, a coarse feed, and corn meal and gluten meal, concentrated feeds.

	Pounds in 100.		
	Hay.	Corn Meal.	Gluten Meal.
Water,	14.00	14.00	9.00
Protein,	8.50	9.60	36.50
Fat,	2.00	3.50	3.00
Extract,	43.10	69.60	47.70
Fiber,	28.20	1.90	2.50
Ash,	4.20	1.40	1.30
Total,	100.00	100.00	100.00
Pounds digestible in above,	48.00	74.00	79.00

First observe that the hay and corn contain about the same amount of protein. We say they are low in protein. Note that the gluten meal is high in protein. In the second place observe that the hay contains a large amount of fiber, while the corn and gluten contain but little. Third, note that the hay contains but forty-eight pounds of actual nutritive or digestible material, while the corn and gluten contain from seventy-five to eighty pounds. The large amount of fiber in the hay causes it to be much less digestible than those feed stuffs containing but small quantities.

The corn meal, with seventy-four pounds of food matter, may be considered a concentrated or refined hay. Aside from its mechanical structure, it differs from the hay in only one important particular—it is very much more digestible. The gluten meal differs from the hay in two particulars, first it is very much more digestible, and second it contains a much larger amount of protein. In general, then, we may say that the concentrated feeds differ from the coarse feeds in two ways: first, they are all more digestible, and second, many of them contain very much larger amounts of protein.

D. THE MOST DESIRABLE COARSE FEEDS.

A very large number of coarse feeds may be mentioned which can be grown successfully upon our northern farms, but

when we attempt to arrange them with reference to their economical value our list is greatly reduced.

The farm is the raw material factory ; the modern dairy cow, the improved machine for converting the crude material into a higher grade product. In the production of raw material the farmer has two important questions to consider. First, the *quality* of the raw material he is producing, (the chemist, speaking in more scientific language, refers to it as the amount of digestible material in the feed); second, the cost of producing this raw material. In times past there has been a considerable misunderstanding between the chemist and farmer. The chemist has thought only about the quality of the material ; the farmer only about the cost. The chemist in his experiments and practical suggestions must consider cost as well as quality if he expects the farmer to derive any benefit from his work, and the farmer in growing his raw material must consider quality as well as cost, and try to ascertain how he can produce the largest quantity of the best quality, for the least outlay of time and energy.

The more we as experimenters have investigated, the more I think we are convinced that the two great sources of raw material are grass and corn. We have not found anything that will replace them. The questions then to be considered in this connection are, when shall the farmer depend upon grass as his chief source of supply, and when upon corn. If he possesses a natural grass farm, let him depend upon hay as his chief source of roughage, because in my judgment, hay is the very cheapest food he can produce. It requires, comparatively speaking, a small outlay to handle the product from an acre. As a grass farmer, he should have an ideal before him ; that each acre shall produce from two and one-half to three tons of hay. In harvesting, do not wait until the blades of grass have become sticks of wood. If you have a large area to cut, make a beginning somewhere just as the grass is coming into blossom. If possible seed some of your land with grasses that bloom early so as not to have all of the grasses come into bloom at once. The following mixture is very good for early hay :

Orchard grass, ... 1 bushel. (14 pounds).
Alsike clover, ... 4 pounds
Red clover, ... 6 pounds.

This mixture will be ready to cut from the 7th to the 15th of June, before the Timothy and Red Top are in blossom. It should be cut just as the blossoms appear. Study how to cut and harvest the hay crop with the least outlay of money. Watch the weather and cut towards sundown if it is promising.

A farmer has use for all the brains he possesses in securing his hay crop in good condition at minimum cost.

If the farmer owns a farm having a light soil, sensitive to drought, he should make more of a specialty of corn for the silo. The first and more important crop of hay is made or unmade between the first of May and the middle of June. If a "spell of dry weather" occurs, the crop will be a light one. Corn on the other hand extends over a longer period of growth, and will withstand the dry weather better than grass. In growing corn, one must use as little hand labor as possible. An early campaign should be begun against the weeds. First use the weeder as soon as the weeds make the slightest showing, and keep it going until the corn is six inches high, and then follow with the fine tooth cultivator. Do not let up on the weeds. It is the early farmer that catches the weeds, as well as the early bird that catches the worm, and it is the early weed as well as the early bird that gets caught.

THE QUANTITY OF CORN TO GROW.

An average acre of corn should give five cows twenty pounds of ensilage a day for seven months, and if grass was the main crop I should plan to grow at least an acre of corn for ensilage for every five cows.

If the farm was not naturally suited to grass I should grow sufficient to give each cow forty pounds per day for at least the same period. This would be two acres of corn for every five cows. On my grass farm I would probably feed some fifteen pounds of hay daily in addition to the ensilage, while on my corn farm seven or eight pounds of hay besides the forty pounds of ensilage.

HOW TO HANDLE THE CORN CROP.

Your own experiment station has conducted such an excellent series of practical experiments on this point, that it is hardly necessary to go into the matter in detail. I believe in the silo. I think it is the best way for the dairyman to handle the crop. The animals eat the silage clean, and enjoy it, especially during the long winter when they can get no green feed. We should endeavor to prevent the corn from souring as much as possible. The way to do this, aside from packing it tightly, is to allow the corn to mature as much as possible. I like to have the ear well in the dough and beginning to harden, before cutting. You will get the largest amount of the least sour food by this method. One problem that confronts the farmer is how to get the corn into the silo with the least amount of help. The nearest solution I can suggest for this problem

is to have several farmers combine and purchase a small power cutter. By exchanging work they can fill the silo without extra help. If one is obliged to hire a cutter at a dollar an hour, together with extra help, the cash outlay is considerable and unduly taxes the resources of the dairyman.

I like to go through the field just previous to cutting, and break off some of the ripest ears as a food for my horses and pigs. I prefer to do this rather than cut and stook the entire plant in the old way.

If some dry corn stover is needed to piece out the hay crop, I would cut the stover fine before feeding it in order to induce the animals to eat it clean. Corn stover fine cut and fed at the rate of six or seven pounds daily has a feeding value nearly equal to average hay. If corn stover is fed in too large quantities the animals soon tire of it, because of its lack of flavor. It also injures the gums more or less, and the result is a decreased consumption and hence a lessened milk yield.

You will notice that I have emphasized the fact that the corn should be quite well matured before cutting for the silo. This also means that we should select varieties for ensilage which will mature in our latitude. I consider it very unwise to attempt to grow Southern varieties of corn in the north. We simply obtain a large amount of stalk with a minimum quantity of nutritive matter.

A word in regard to the leguminous crops. I believe in clover, the medium red and the alsike. I like to use some of the seed in all my grass mixtures. If you are successful in curing clover, so as not to have a great loss by the breaking off of the leaves, it is a very desirable crop to raise and feed. The coming season on land which I intend to keep in corn for two or three years I shall seed with twenty pounds of Red clover seed to the acre after the last hoeing of the corn. I shall allow this clover to grow until the 20th or 25th of the next May, then turn it under, spread on 250 pounds of muriate of potash, 300 pounds of acid phosphate, and 150 pounds of nitrate of soda to the acre, and seed to corn again.

We have had considerable success at Amherst with the soy bean, the medium green variety, brought from Japan. It is valuable to be fed green or as a silage crop. We have grown at the rate of nine tons per acre. The beans have been planted with a corn planter about a bean to the inch in the row, the rows two and one-half feet apart. They are cared for in the same way as corn, during the growing season. They need no support, have a large amount of foliage, and during the latter part of August cover the field with a dense mass of green foliage. They are ready to cut in September with corn for the silo, if sown about May 25th at the rate of eighteen quarts of

seed to the acre; or they may be cut for green feed the latter part of August. If allowed to stand late, their stems become woody. A mixture of two-thirds corn and one-third beans makes excellent silage. The objection to the soy bean is the expense of putting it into the silo. The stems are tough, and one is obliged to cut them with a heavy scythe. They then have to be brought together in piles and loaded onto a wagon with a fork. They do not handle as easily as corn, yield one third less, and it is a question whether it is not more economical to buy protein in the form of cottonseed or gluten meals than to grow it in the form of soy beans. Last year I planted about one-fourth acre of corn and beans together. The corn was planted with a horse planter, and the beans put in the same rows with the corn, by the aid of a hand planter. We secured a very good crop in this way, and it is my intention to try it on a larger scale the coming season.

Grass and corn, clover and possibly beans, seem to be the most desirable coarse fodders the farmer can produce for the purposes of feeding his dairy herd six or seven months in the year. Many others have been called, but these few chosen.

SUMMER CROPS.

During the months, May, June, July, August and September, the pastures of the Green Mountain State will furnish the bulk of the coarse feed needed. We, however, in Massachusetts find it economical to grow many soiling crops to supplement our pastures, especially during the months of July and August, and many of our dairymen with but a limited pasture area, grow more or less green crops during the entire summer season. Below is presented a schedule of soiling crops which have proved successful at our station.

SOILING CROPS.

(10 cows entire soiling.)

Kind.	Seed per acre.	Time of seeding.	Area.	Time of cutting.
Wheat.	2 bushels.	Sept. 10–15.	½ acre.	May 25—June 5.
Orchard grass, or Italian rye " and Alsike clover.	1 bushel grass and 8 lbs. clover.	August 1.	½ acre.	June 5–20.
Peas and Oats.	1½ bush. Canada 1½ bush. oats.	April 25.	½ acre.	June 25–Jul. 10.
" "	"	May 10.	" "	July 10–20.
" "	"	" 30.	" "	July 20–30.
Barnyard millet and peas.	6 quarts millet. ¾ bu. Canada.	May 10.	⅓ acre.	Aug. 1–10.
" " " "	"	" 25.	" "	" 10–20.
Corn and Soy beans.	7 quarts corn, 8 quarts beans.	May 20.	" "	Aug. 20–30.
" " " "	"	June 5.	" "	Sept. 1–10.
Corn.	14 quarts corn.	May 25.		" 10—Oct. 1.
Barley and peas.	1½ bushels each.	July 25.	1 acre.	Oct. 1–20.

It is not meant that each farmer should plant any such succession of crops, but rather the above table indicates what has been found practicable by those who have been obliged to depend to a considerable extent upon soiling. The peas and oats are most excellent for July feed. This material makes good hay if cut early. The so-called barnyard millet (*panicum crus-galli*) is a variety imported from Japan. It is a large yielder and a very rapid grower. It is rather sensitive to dry weather and thrives best upon moist soils. It is a warm weather crop. Mixed with pea fodder it forms a most desirable combination for August. We have grown some fourteen tons of green fodder per acre on land in good average condition. In sowing peas and oats, or peas and millet, the peas can be lightly plowed or deeply harrowed in, and the oats or millet rather lightly harrowed in. I consider it safe to sow the seed of the oats or millet at about the same time as the peas.

Following the millet and peas are the corn and beans which also gives a very satisfactory feed. Our method of planting has already been alluded to. The barley and peas help out the

feed supply of the late autumn when the pastures yield but little food, and form the stepping stone to the silo in November.

The great objection to growing the numerous green crops just mentioned is the cost of labor involved. Numerous small pieces of land must be plowed, harrowed and seeded at various times during the busy summer months. Again, the cost of cutting and bringing the green material to the barn is considerable, it being a puttering job, taking a considerable amount of time. Another method of supplying feed during the summer to help out the pasture is to possess a summer silo, which should be filled with corn the autumn previous. This silo should be quite deep and have a very small surface area—not over five square feet per cow. The cows can be fed about twenty pounds of silage per day, and about two quarts of some grain, as gluten feed or a few quarts of a mixture of one-third cotton or gluten meal and two-thirds bran. On hay farms, hay can be fed in place of the silage. The writer has not been very partial to the summer silo, for the reason that after animals have been fed thirty or forty pounds of silage during the entire winter, a change of feed from sour ensilage to unfermented green crops is desirable. Many, however, are employing the silo as an adjunct to short pasture, with seeming success.

Clover of itself makes an excellent summer feed, fed at the rate of thirty-five or forty pounds daily. When this amount is fed in addition to the pasture feed, no grain is necessary. By having an acre of clover for every ten cows, one secures a large amount of the very best green material during the summer months. The land for this purpose should be kept very rich, and should produce three good crops during the season. By the time the first cutting is completed, a beginning can be made on the second.

Having considered somewhat in detail the most suitable coarse feeds, let us turn our attention for a few moments to the concentrated feeds.

E. CLASSIFICATION OF CONCENTRATED FEEDS.

The term "concentrated feed," taken in its broadest sense, is meant to include the grains and other seeds of agricultural plants, as well as their manifold by-products left behind in the process of oil extraction and in the preparation of human foods. As here used it is applied more particularly to the various by-products.

Division I. Protein Feeds.			Division II. Carbohydrate or starchy feeds.
Class I. *30 to 45% protein.* 50 to 60% *carbohyd's. 75 to 90% digestible.	Class II. *20 to 30% protein.* 60 to 70% *carbohyd's. 80 to 85% digestible.	Class III. *14 to 20% protein.* 70 to 75% *carbohyd's. 60 to 75% digestible.	Class IV. *8 to 14% protein.* 75 to 85% *carbohyd's. 75 to 90% digestible.
Cottonseed meal. Linseed meals. Chicago, Cream, King, Hammond and Star gluten meals.	Buffalo, Golden, Diamond, Davenport, Climax, Joliet, and Standard gluten feeds made from corn, Atlas meal, dried brewers' grain, and malt sprouts.	Wheat brans and middlings, "mixed feeds" and H. O. dairy feed.	Wheat, barley, rye, oats, corn, cerealine, hominy, and oat feeds, corn and oat chop, corn germ feed, and chop feed.

It will be observed that the above detailed classification is based upon the amount of protein the various feed stuffs contain. Those in Class I—the cotton, linseed and gluten meals—contain from 30 to 45 per cent; those in Class II—the gluten feeds, brewers' grains and malt sprouts—20 to 30 per cent; those in Class III—the wheat by-products—14 to 20 per cent; while those in Class IV—the starchy feeds—contain about 10 per cent protein. In this connection it might be of interest to present what the writer terms the "protein standard"† for these various feeds.

	FEED STUFFS.	PROTEIN STANDARD.
Starchy (carbohydrate) feeds.	Corn meal,	9 per cent.
	Hominy meal or chop,	10-11 "
	Chop feed,	8-9 "
	Oat feeds,	9-10 "
	Corn and oat feeds,	9 "
	H. O. horse feed,	11 "
Protein feeds.	Wheat bran,	16 "
	Wheat middlings,	18-20 "
	Mixed feed,	17 "
	Dried brewers' grains,	‡22 "
	Malt sprouts,	24 "
	H. O. dairy feed.	19 "
	H. O. poultry feed,	17 "
	American poultry feed,	14 "
	Buffalo and Golden gluten feeds,	28 "
	Other gluten feeds,	22-24 "
	Gluten meals,§	36 "
	Cleveland flax meal,	39 "
	O. P. linseed meal,	36 "
	Cottonseed meal,	42 "

*Including fat reduced to carbohydrates.

†By "protein standard" is meant the per cent of protein an unadulterated feed should contain.

‡Minimum.

§King gluten meal should have 33 per cent protein and 15 per cent fat.

It is frequently asked which are the cheapest and best grain feeds for our animals. This cannot be answered directly, for the reason that market prices are likely to vary widely and what may be cheap feed to-day, might be expensive feed to-morrow. A short crop of corn would make corn meal and the gluten products high in price, while a large wheat crop would mean low prices for bran, middlings and mixed wheat feeds.*

The writer regards the gluten products as among the best and safest foods for milk production. Cotton seed and linseed meals are also good. Wheat products are quite desirable but are likely to be relatively high in price. The same can be said of ready mixed feeds. Oat feeds—the refuse from oat meal mills—containing from 40 to 50 per cent of hulls, are also relatively expensive. In order to help the farmer in ascertaining the relative commercial values of the numerous feeds the following key is presented :

KEY TO COMPARATIVE VALUES OF CONCENTRATED FEEDS.

Starchy (carbohydrate) feeds.	Corn meal,	100
	Hominy meal or chop,	100
	Cerealine feed,	100
	Chop feed,	80*
	Quaker oat feed,	85
	Oat feeds (excessive hulls),	75
	Victor corn and oat feed,	95
	H. O. horse feed,	95
Protein feeds.	Wheat bran,	85
	Wheat middlings,	100-110†
	Mixed feed,	90-95‡
	Dried brewers' grains,	100
	Malt-sprouts,	100
	H. O. dairy feed,	103
	Buffalo and Golden gluten feeds,	125
	Other gluten feeds,	120
	Gluten meals,	152
	Cleveland flax meal,	138
	O. P. linseed meals,	135
	Cotton seed meal,	152

The above feedstuffs are divided into starchy and protein feeds. The former are purchased primarily to increase the digestible matter in the daily ration, while the latter are bought not alone to give more digestible material but to increase the *protein* in the ration fed to the animal.

HOW TO USE THE KEY.

It is not possible in this connection to show the relative effects of the various feed stuffs on the flow of milk or the pro-

*About 1600 pounds bran and 400 pounds fine middlings.
†Estimated but not actually determined.
‡The 110 value refers to fine light colored middlings with 19 per cent protein.

duction of beef. The figures are offered rather as a key to the *comparative commercial values* of the different feeds based on the nutrients contained in them. Thus if corn meal is worth 100, Quaker oat feed would be worth 85 ; or if wheat bran is worth 85, cottonseed meal would be worth 152. These figures can be easily converted into dollars. Thus if corn meal is worth $16 per ton or 100, Quaker oat feed would be worth 85 per cent of $16 or $13.60, the amount the farmer can afford to pay for the oat feed. Again with cottonseed meal worth $22, what can the farmer afford to pay for old process linseed meal? Cottonseed meals equals 152, or $22, and linseed meal 135 or $19.60. We have a case in simple proportion. 152 : 135 : : $22 : x =$19.60, the value of a ton of linseed. It must not be forgotten that these figures do not take into consideration the mechanical condition, or the particularly favorable effect which some feeds are supposed to exert upon the general health of the animal.

Is it possible for us as dairymen to get along without feeding concentrated feeds? In attempting to answer this question we shall be led to consider the amount of protein, fat and carbohydrates needed daily by the dairy cow.

A very large number of experiments have been made to ascertain the amount and proportions of protein, fat and carbohydrates necessary to enable the cow to do her best at the pail and churn. Some twenty years ago, Wolff, a German investigator brought together all experiments that have been made, and concluded that the dairy cow of one thousand pounds live weight, yielding ten to fourteen quarts of milk, needed the following amounts of digestible matter daily.

	Protein	Fat	Carbohydrates	Total	Proportion of protein to carbohydrates
Pounds	2.5	.4	12.5	15.4	1:5.4

Many later experiments have been made since Wolff expressed his opinion as to the quantities and proportions needed. We have at the Massachusetts station given a good deal of attention to the problem; and the longer we experiment, the more we are convinced that Wolff was right. Now if we feed a milch cow all the hay she will consume, we know that even though she has been given enough to satisfy her appetite, she will not yield a maximum amount of milk. She will have eaten perhaps twenty-six to twenty-eight pounds of hay, which contained essentially the following amounts of nutrients:

	Protein	Fat	Carbohydrates	Total	Proportion or ratio.
Pounds	1.4	.4	12.2	14.2	1:9.5

We note in the first place that, because the hay is a comparatively indigestible feed, although the animal eats her fill she only secures some 14.2 pounds of digestible matter, when 16 are needed. Secondly it will be seen that instead of securing 2.5 pounds of protein she obtains from the hay but 1.4 pounds. Now let us replace six or seven pounds of the hay with an equal quantity of corn meal. The hay and meal would show approximately these figures:

	Protein	Fat	Carbohydrates	Total	Proportion or ratio.
Pounds	1.5	.5	14.	16	1:10

The animal would secure all the digestible material she would need, but, because the corn meal is deficient in protein, the ration must also be; we see that it contains only 1.5 pounds. We feed therefore grains or concentrated feeds, first to give the animal the requisite amount of digestible material, and second to increase the amount of protein in the ration. Our own experiments have told us that, feeding sixteen pounds of digestible matter per day, containing 2 pounds of protein—we get five per cent more milk than if the ration contained 1.5 pounds, and if the ration contains 2.5 pounds we get ten per cent more milk than if the ration only contains 1.5 pounds.

I hardly see for the above reasons how it would be economical to get along without feeding more or less concentrated feeds. The coarse feeds of the farm, as has been shown, are relatively indigestible as well as deficient in protein. From some source then must be procured feeds of a high digestibility and rich in protein, if one is to expect large and continuous milk yields. It may be remarked, parenthetically, that such feeds are likewise rich in fertilizing constituents.

Our experimenters are studying the problem of how to raise as much as possible of all feed-stuffs upon our own farms, and thus render the farmer independent of the grain dealer. While we may in a measure succeed, I am of the opinion that because of the great industries in our country engaged in manufacturing a variety of materials from the grains grown in the west and south, the by-products resulting can be sold at such a low price that it will still be economical for the farmers of the east to purchase these to an extent, rather than to produce them at home. In this connection we must not forget that the farms should not be allowed to decrease in fertility. Although the dairy farmer produces chiefly butter and thus sells but little fertility from his land, it will still be necessary to replace the waste, and it is far more economical to put back this fertility through the cows, than to buy it in the form of fertilizers.

F. PROPER COMBINATIONS OF COARSE AND CONCENTRATED FEEDS.

Having considered in detail the relative value of coarse and concentrated feeds, it will be wise in closing to say a few words relative to the proper combinations to be made in order to secure reasonably correct amounts of protein, fat and carbohydrates, or to produce what is called a balanced ration.

During the six or seven winter months, the hay farmer will feed twenty to twenty-five pounds of ensilage daily and all the hay the animals will eat. As a grain ration to go with the above I would feed five or six pounds of a mixture of one-third corn or hominy meal, and two-thirds gluten, cotton or linseed meal. A mixture of the same quantity of two-thirds gluten feed and one-third cotton seed meal would also be quite suitable. Believing that bran as a diluter for the more concentrated feeds is relatively expensive, I would put my grains upon the ensilage, allowing the latter to do the mechanical work of the bran. During the winter months the corn farmer can feed forty pounds of ensilage and seven to ten pounds of hay per day, in addition to six pounds of gluten feed, or two pounds of cotton or linseed meal and four pounds of gluten feed. The grain can be spread upon the ensilage as already stated.

Many other grain combinations might be suggested depending upon the cost and variety of materials to be had in local markets. A few words of suggestion from your experiment station from time to time will be valuable.

Suitable summer feeds, and feed combinations, have already been discussed. Pasture grass of itself is a perfectly balanced ration for the dairy cow. Oats and peas, millet and peas, corn and beans, and clover, also furnish considerable amounts of protein, and as a rule are sufficient without any large quantity of grain.

I have thus attempted to bring to your attention the groups of substances composing the various cattle feeds, the most economical coarse and concentrated feed stuffs to be fed, the amount the dairy cow needs of the several nutriments in order to enable her to do her best work, and how to combine the several feed stuffs in order to secure that end.

HOW CAN NEW ENGLAND COMPETE WITH THE WEST IN DAIRYING.

PROF. JOSEPH L. HILLS, Director, Vt. Agl. Exp. Station, Burlington, Vt.

I have approached the consideration of the subject of Western competition in dairying with some diffidence because my life work has lain along lines which have not enabled me to take a comprehensive view of subjects dealing intimately with market conditions. To cover such a subject broadly, one needs to occupy the several standpoints of producer, commission man and consumer. I have read, studied, thought, conversed, experimented more or less on the general subject and on allied topics in connection with college, dairy school, farm-institute and experiment station work, but almost always from the standpoint of the producer. If, then, my ideas are one sided, if I lay too much stress on production, if my errors of omission are only less glaring than those of commission, I trust that my hearers will not hesitate to supply the deficiencies in the discussion. Pray be free to debate, to controvert, to differ at your hearts' content ; thus will the grain be threshed from the straw.

Lies were classified once by somebody as white lies, black lies and statistics. Again it has been said that while "figgers don't lie, some liars figger." Notwithstanding these strictures, I am going to risk calling your attention for a moment to certain statistics showing the wonderful increase in the dairy industry in the West during recent years and the relatively small volume of New England's dairy interests. The only data at all adequate to the purpose are given in the census of 1890, and refer on the one hand to the six New England States, and on the other to the twelve Northern Central States, Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska and Kansas, all of which are now largely engaged in dairy husbandry.

Cows. There were in 1890 ten times as many cows in the Northern Central States as in the New England States, (New England, 822,001 ; Northern Central States, 8,240,999). During the 40 years from 1850 to 1890, the number of cows in New England increased 35 per cent, while in the same time the number in the Northern Central States was multiplied 527 per

cent, (New England, 1850, 608,219; 1890, 822,001; Northern Central States, 1850, 1,564,219; 1890, 8,240,999). Indeed the increase between 1880 and 1890 in the number of cows kept in the Northern Central States was 53 per cent as against 35 per cent increase in 40 years in the New England States. This increase was three and a half times the total number of cows now held in New England (Northern Central States 1880, 5,402,-081; 1890, 8,240,999).

Products. Eight times as much milk, 8½ times as much butter, and 12½ times as much cheese was made in 1890 in the Northern Central States as in the New England States, (New England, 338,911,582 gallons milk; Northern Central States 2,-719,414,765 gallons. New England, 77,240,024 pounds butter; Northern Central States, 650,551,588 pounds. New England, 9,107,034 pounds cheese; Northern Central States, 110,225,861 pounds).

The milk, butter and cheese products of the Northern Central States during the census year were 52, 54½ and 43½ per cent respectively of the total productions of the entire country, while those of the New England States were respectively but 6½, 6½ and 3½ per cent.

If, however, we turn to the data showing the number of cows and the production per square mile, we find that the difference between the Western States and the New England States in this respect is purely one of area, that New England is outclassed because of its small expanse of territory. We find Vermont, Massachusetts, Rhode Island and Connecticut ranking among the forty-eight states and territories 4th, 7th, 5th and 3rd in the density of cow population; 1st, 9th, 13th and 4th in butter production per square mile, and 3rd, 15th, 5th and 11th in cheese production per square mile. Only two of the twelve Northern Central States rank less than 10th in density of cow population, but four out of twelve rank less than 10th in butter production per square mile, and but five out of twelve less than 10th in cheese production per square mile.

These figures are doubtless not new to this audience. They serve, however, to show that the volume of New England's dairy production in proportion to her area compared favorably with that of the West in 1890. Yet we should remember, however, that dairying has taken great strides in the Dakotas, Kansas, Nebraska and Minnesota since 1890, that there has been but relatively small increase in the volume of New England's business in this respect, and that the figures given are low of truth when applied to to-day's conditions.

To all intents and purposes, New England sells its dairy products at home only. This of itself, however, is a great and ample market. But more and more each year the goods of the

West are elbowing the home-made product out of its own place. Every year the proportion of Western goods sold in the Boston market increases, while that of Eastern make diminishes. This is where the shoe pinches. It behooves us then as dairymen to consider carefully any and every legitimate means which may be suggested looking towards the wider use of Eastern dairy products.

A general in planning a campaign seeks to learn the nature, extent, location and disposition of the enemy's forces, and the advantages he possesses; he measures against them his own resources; and, finally, studies wherein he may lesson his opponent's chances of battle and improve his own. Let us, similarly, in surveying the field of strife for supremacy in the dairy trade observe:

(1.) What marked advantages over the East are possessed by the West.

(2.) Wherein has New England advantage over Western rivalry.

(3.) How may New England dairying more successfully meet the competition of the great West.

I. WESTERN ADVANTAGES.

Several circumstances conspire to favor Western success in dairying, among which may be mentioned

1. Cheap feed.
2. Large territory and large numbers.
3. Longer pasture season.
4. Ready use of new methods.
5. Educative agencies.

(1.) *Cheap feed.* This advantage is of stupendous importance. The low cost for food in the making of Western butter more than any other one factor makes Eastern competition increasingly difficult. The Western farmer can usually raise a ton of dry matter in silage at less cost than can his Eastern brother; his hay is grown cheaper; and as for grain feeds, the comparison is most disheartening, mill-stuffs averaging throughout the West two-thirds of Eastern prices, while corn is so plenty that it is sometimes cheaper to use as fuel than is coal. Prof. Hæcker reports the manufacture of butter from a large herd at less than ten cents a pound for food the year round, buying, as he told the writer last fall, bran at $4.00 to $4.50 per ton f. o. b. Minneapolis in car load lots. The difference in freight rates on a ton of bran and on the butter which a ton of bran will make is large. Such a handicap as this is indeed difficult to overcome.

(2.) *Larger territory and numbers.* I think that I have said enough under this head when considering the statistics given a few minutes ago to suffice, except to call attention to the surplus of production over consumption in the West and the reverse of this condition in New England, and to the fact that the volume of the West's production gives it a standing in the commercial world not accorded to smaller outputs.

(3.) *Longer pasture season.* This advantage pertains more particularly to Missouri and Kansas. Kentucky and Tennessee of the Southern States are rapidly becoming dairy states in the true sense of the word. Their milder climates and the prolongation of outdoor bovine life in these states tends to lower the cost of butter production.

(4.) *Ready use of new methods.* Under this heading and again further along in this paper I shall take occasion to refer to the ultra-conservatism of the New England farmer. The Western creamery and factory proprietors or managers, as a class, are far and away ahead of Easterners in similar positions in their study of newer methods, and appliances and in adopting the same wherever feasible. For example, the following statement was made from the platform at the last meeting of this Association by a prominent commission merchant of Boston, one who has large acquaintance with Vermont goods: "I have been told by good authority that last year about ninety per cent of all the butter from the West shipped into New York was shipped in parchment-lined tubs. I do not know of a single creamery in Vermont that is lining its tubs with parchment paper." The statement was not denied. The first skim-milk weigher in Vermont was put in last winter; they have been used in the West for lo, these many years. It is common remark among commission men and the dairy supply trade that the West promptly meets new demands, anticipates them perhaps; that while sometimes investing in new apparatus of doubtful utility, or adopting methods of questionable wisdom, it leads in new ideas. It seems to me that we may well copy from the West in this matter, and that we may well remember the adage that he who makes no mistakes generally makes nothing.

5. *Educative agencies.* With all due respect to the good work being done along agricultural lines by the various colleges, stations, boards of agriculture and the press of the New England States, I submit that the agricultural educative agencies in the West average higher in efficiency, in getting home dairy knowledge to the people than do those of the New England States. And, more important yet, as has been already indicated, the eyes and ears of their constituencies seem to be more open, their hearts and minds more receptive, and their hands and energies more

active to apply the dairy gospel than is the case in the East. They are "built that way," they hustle more. They have earned their success and they deserve it. Let us emulate them.

II. EASTERN ADVANTAGES.

There is, however, a reverse side to this picture. New England dairying possesses certain advantages which have been helpful in the past and which may be useful in the future. They may be enumerated as follows:

1. Better cows.
2. Former reputation.
3. Proximity to market.
4. Special goods.

1. Better cows. It is quite safe to say that New England cows will average better than those of other sections of the country, and that the production per cow is larger than elsewhere. The cow is the foundation of all branches of dairying, hence this is an important advantage, one not to be underestimated, one which should in every possible way be increased. Of this more anon.

2. Former reputation. Time was when Vermont butter, like Vermont maple sugar, was the standard of excellence throughout the East. "Northern Creamery," that is to say, New Hampshire and Vermont creamery butter has heretofore sold and often sells today on Boston market at a higher figure than Western brands of the same grade because of a reputation founded, it must be acknowledged, more upon tradition than by actual superiority. This old time reputation has been a marked advantage, but tradition cannot much longer sustain the distinction in view of the greatly lessening proportion of New England's total output that is sold in the large markets.

(3.) *Proximity to markets.* "Once upon a time," as they say in fairy tales, the nearness to market was an important factor in the trade, but refrigerator cars, cold storage, frozen butter, low freight rates and the like have made this advantage a broken reed upon which none can lean with safety.

(4.) *Special goods.* Thus far the West has not been able to compete with the East in the New England markets in the milk or cream trade. This trade is a large and growing outlet for New England dairy products, particularly in New Hampshire, Massachusetts, Rhode Island and Connecticut. When, however, we consider what pasteurization and freezing do, when we think of what liquid air has done and may yet do in economic fields, surely it is far from safe for us to assume that the great West will not before long be placing frozen bricks of milk and cream, pasteurized

cream, sterilized condensed milk and the like in New England markets on an equal footing with home made products.

Let us now balance accounts.

Against the cheaper food, larger area and numbers and modern methods of the bustling West may be placed a somewhat better grade of Eastern cattle and a milk and cream trade thus far not threatened by competition. The candid observer must confess that the West has the best of it. The difficulty of competing with the cheaply made butter of the West is yearly increasing. No protective tariff can avail, legislation is to be invoked to no purpose. The business conditions of the present day are very different from those of our forefathers and will so remain. It is folly to bemoan the high prices of former days, useless to combat modern business conditions with out of date methods or ancient prejudices. I know of no easy way to success, no royal road to competency, no sure cure to the ills of this dangerous competition. The sole resource of New England dairymen lies in the awakening of their own energies. They may most surely stem the tide of Western rivalry by a thorough study of the dairy business, by the application of business methods to their vocation, by the adoption of such modern ideas as seem applicable to their conditions.

The dairyman of today, to be successful, must work with his head quite as much as with his hands. He must call upon his brain as well as upon his muscle. He may well recollect the remark of one of the famous painters of the last generation whose coloring was the despair of his fellow artists, who, when asked with what he mixed his paints to produce such wonderful effects, replied, "With brains."

III. HOW TO MEET WESTERN COMPETITION.

In my judgment those engaged in dairy husbandry in New England, in order to hold their local markets against the rapid inroads of Western competition, need to consider three fundamentals, to study, if you will, three courses in the school of dairy experience.

1. Economy of manufacture.
2. Markets.
3. The dairy business.

I freely grant that this triad is not stated in a logical order, that in putting the dairy business last I seem to have placed the horse after the cart. Yet I wished to make this distinction between headings 1 and 3 for reasons which will be apparent as the discussion develops.

(1.) ECONOMY OF MANUFACTURE.

Under this heading one needs to consider means of economizing, either by lessening the cost or improving the plant. I have divided the matter for convenience and clearness of discussion under five sub-heads :

(a) Machines.
(b) Crude stock.
(c) Methods.
(d) Nature of products.
(e) Character of products.

(a) *Economy in machines*, i. e., cows, dairy apparatus, etc. Some dairy authorities have been prone to look upon the cow as a machine only, to speak of the food as fuel to run the engine and of the milk as the product of machine work. This view is one-sided and, in many ways, ill-conceived, yet for the purposes of the present argument and classification, the cow may well be considered as a part of the dairyman's plant or machinery for manufacturing finished products. I have already said that New England dairy cows average better, that is to say, produce more than do Western cows. So far so good, but better is not best. When the odds are so heavily against us, every effort needs be made and here endeavor is readily directed. Let us turn for a moment to Vermont statistics. Some years ago Hon. Victor I. Spear, then statistical secretary of the State Board of Agriculture, gathered data in the course of his official work showing the average butter production per cow for the State. The result showed the average annual yield to be 156 pounds per cow, several entire townships being over the 200 pound mark and some below the 100 pound limit. The range of production was from 92 to 259 pounds for entire townships. Now 156 pounds is, I believe, a larger average production than that of any other State in the Union. Yet it is far from what it might be, far from what it ought to be. It is not a yield which, at present prices for butter, for grain feed and for hired labor will add largely to our wealth. The margin of profit is dragged down by the keeping of unprofitable animals, cow boarders.

Before the Babcock test was devised, when ready, cheap and accurate methods of estimating the dairy worth of individual animals were lacking, there was valid excuse for keeping bovine dead-beats. But no man of even ordinary intelligence can plead inability to-day. A simple test is at hand, one that requires but a minimum outlay of time, money, knowledge and brains. Many a man who has used the Babcock test in a proper manner to test the merits of his various animals has made more money

with half his herd than formerly when the barn was full. Some years ago the dairyman of the Vermont Experiment Station left us to become dairyman on the Long Island estate of Mr. W. K. Vanderbilt. Soon after entering upon his new employ he wrote me as follows: "The Babcock test has killed a dozen of our cows. Mr. Vanderbilt says he cannot afford to keep cows which do not pay their way." If we may judge by the actions of many of our dairymen not only in New England but the world over, (and we must remember that actions speak louder than words,) if, I say, we may judge by their actions, there are thousands of dairymen who can afford to keep cows which W. K. Vanderbilt is unable to keep. The very first step which should be taken by every dairyman whose average production per cow is under 200 pounds, is to grade up his herd by purchase or by breeding, or both, as seems most expedient. The purchase of a good bull is usually the first move, followed by good care and judicious feeding of such cows as are worthy of it. May I not suggest here, moreover, that the raising of a larger proportion of the calves now slaughtered would be in the direction of wisdom. Recent statistics taken by the State Board of Agriculture show a marked decrease in the number of dairy cows in Vermont. This decrease is brought about more particularly because of large sales to Massachusetts and the failure of farmers to raise their own stock. If more of our dairymen would make use of the Babcock test determine the dairy abilities of their individual animals and would raise calves from such cows as prove to be the most successful milkers, it would go far towards elevating the standard of excellence in their herds.

The class of cows and their adaptation to the particular kind of dairying in view is of importance. I do not desire, however, to enter into the quarrel of the breeds, but am simply suggesting the wisdom of looking into this matter and the folly, as Gov. Hoard aptly puts it, of hunting for birds with a fox hound or for butter with a beef animal.

The matter of dairy apparatus and appliances merits careful study. The market for all classes of dairy goods becomes yearly more critical and margins of profit grew continually more narrow, particularly if modern apparatus and methods are not used to meet these demands. Mill owners throw aside machinery which cost tens of thousands of dollars, machinery but little worn, and replace it with other apparatus perhaps yet more costly, which in its turn in a few years, with its value hardly impaired by use, is cast aside for yet another lot of machines. Why? To save a fraction of a cent in the cost of making a yard of cloth, to lessen the expense of labor, to reduce power bills—in short to economize in manufacture. Similarly the wasteful shallowpan or deep setting creamer of earlier days

must, for greatest profit, be superseded by the centrifugal separator,—the eight quart can by the sealed glass bottle. Whatever class of dairying New England is engaged in, it is the part of wisdom to adopt such apparatus as will lessen waste and improve quality. It is not my wish to recommend this or that piece of apparatus, but in general to urge the wider use of modern machines for dairy purposes.

(b) *Economy in crude stock*, i. e., home grown and purchased feeds. This, as Rudyard Kipling says, "is another story." The discussion of economical dairy feeding in all its phases would take far more time than can be given to it here.

In the brief time which can be allotted to this section of the general subject, I can hardly do more than allude to the salient points. Without attempting to go into the matter of the science of stock feeding, let me call attention to what appear to me to be the more economical roughages and concentrates, and what are probably uneconomical at ruling prices.

I want you to remember, as I have done, a remark of Director Jordan, of the New York station, made in his address to this Association last year. His epigrammatical statement struck me as very apt and seems worthy of emphasis and reiteration. I believe that it strikes the keynote of the successful dairy practice of to-day in this latitude in so far as it pertains to feeding. He said that the "proper function of the farm in dairy feeding is that of a carbohydrate factory and the proper function of the market was that of a protein supply."

What did he mean by this statement? He meant, I think, three things:

(*a*.) That carbohydrates were grown upon the farm with relative ease, but that it was difficult and usually impossible to grow enough protein upon the farm to provide a large number of dairy cows with a balanced ration.

(*b*.) That since the by-products of several industries are notably rich in protein and are sold at fairly reasonable prices, it was often cheaper to buy this material than to raise it.

(*c*.) That while the farm-growing of protein was to be encouraged, yet it was usually in the line of economy to grow carbohydrates in as large amounts as possible, and to buy protein in order to supplement this growth, thus properly balancing the ration, provided the cows to which the ration was to be fed were of the proper grade.

In my judgment the more common roughages and concentrates may be classified as economical and uneconomical, as follows:

ECONOMICAL ROUGHAGES.

1. Early cut hay.
2. Silage from matured corn.
3. Oats and peas.
4. Clover.

UNECONOMICAL ROUGHAGES.

1. Late cut hay.
2. Silage from immature corn.
3. Roots.
4. New and untried crops.

ECONOMICAL CONCENTRATES.

1. Cottonseed meal.
2. Linseed meals.
3. Certain gluten meals and feeds.
4. Dried brewers' grains, malt sprouts, etc.
5. Bran, middlings, etc.
6. Corn meal (sometimes).

UNECONOMICAL CONCENTRATES.

1. Corn meal (usually.)
2. Oats.
3. Oat feeds.
4. Mixed feeds or provenders.
5. Condimental foods, etc.

In the amount of time which we have at our command, it will hardly pay us to indicate why I have listed some of these materials as economical. It may not be amiss, however, for me to spend a brief moment in giving the reasons why I have classified some of these as uneconomical. Late cut hay is relatively indigestible, its quality notably inferior. Silage from immature corn contains but a small proportion of the feeding value that may be obtained if the kernels are allowed to reach the glazing period. Roots, while valuable things for dairy feeding, are relatively expensive sources of digestible carbohydrates as compared with the corn crop. New and untried crops are better experimented with at the stations than by farmers. Of the purchased concentrates, corn meal is usually uneconomical, because it is rich in carbohydrates and it is protein rather than carbohydrates which we should buy. Oats are usually uneconomical at the prices asked. Oat feeds are generally made up of oat hulls, refuse oats and the like, fortified some-

times with other materials, and at the prices asked are relatively expensive. Much the same may be said of many of the mixed feeds and provenders. Touching condimental foods, it may be said that they seldom if ever increase production or materially better the condition of healthy animals. Of course, in selecting fodders and feeds and in making up the ration, one needs to consider not only the digestible dry matter, the digestible nutrients, but likewise the effect which the various materials may have upon the health of the animal, upon the quality of product, upon the quality of manure, the relation of cost to value and the dairy character of the herd. This latter point in particular is worth considering. It is folly to feed high grade feed to low grade cows.

(c) *Economy in methods.* Shall New England dairying be private or associate? Is the old-time idea of a farmer's independence to be emphasized or minimized? Rightfully or wrongfully, wisely or unwisely, the tendency of all modern business operations is in the direction of aggregation. The department stores, the trusts, combines, and the like, are familiar instances. The same trend is evident in dairy operations. Co-operative or proprietary creameries and cheese factories and the like, are thickly dotted all over the map of New England outside of the section devoted to supplying whole milk to the metropolitan district. Dairy butter, as such, even though of first quality, ranks below creamery butter of even grade. The question answers itself. New England dairying, outside of isolated cases, must of necessity become more and more associate in its methods in order to compete with any degree of success with the products of similar methods made elsewhere.

(d) *Nature of products*, i. e., milk, butter, cheese, cream, by-products, etc. Thus far Western competition has been felt in butter and in cheese alone. New England dairymen have only had to compete with each other and to wrestle with the contractors in the matter of milk supply, while the cream business is still profitable. The consumer now takes dairy products in several forms, milk, butter, cheese of a dozen kinds, cream, condensed milk, by-products, certified milk, modified milk, ice cream and the like, while the by-products, skim milk, butter milk and cheese are made into a considerable number of materials of dietetic or industrial use. Did time permit, I would like to call attention to the considerable income which New England dairymen may yet obtain through a more reasonable and economical use of by-products. This, however, is of the future rather than of the present. Milk, butter and cheese must always be made the main dairy products. Many individuals may solve for themselves the problem of competition, both Western and of home origin, by entering into, alone

or in combination with neighbors, the manufacture of certain dairy specialties, such as special brands of cheese, of certified milk, or things of like character. I doubt whether, for instance, the certified milk business is likely to be overdone in the vicinity of Boston for many years. Many of the foreign cheeses, for which fancy prices are paid, may be closely imitated on this side of the water. Indeed, a few New York and Wisconsin factories are to-day making several cheeses practically identical with the imported article.

(e) *Character of products*, i. e., quality. The best of cows, be they fed ever so well, their milk sold as such or made into butter, cheese or what not, avail not in the struggle to meet Western competition if the quality of the final product be inferior. Our Western cousins have made rapid strides in this respect in recent years. The advantages already enumerated, particularly the educational ones, have been important factors in this advancement. The superiority of New England dairy products no longer stands unquestioned. It remains, therefore, for us to put forth every effort to improve what is already good. We must gild refined gold—the lily shall be painted. How is this to be brought about? I know of no one thing more potent for ill in this matter than the bacterial content of the milk furnished by the different patrons of a creamery, cheese factory or milk car. Other considerations such as character of feed, stage of lactation, method of handling, etc., enter in to affect the quality of the product, factors which would be well worth our attention did time and space permit. I should distinctly fail in my duty, however, if I neglected to refer to the vital relation of the germ content of milk to its usefulness in dairy operations.

I need not tell this audience the now trite story of the bacterium, how its growth and multiplication in milk causes the familiar souring, how sometimes desirable aromas, sometimes disagreeable flavors are developed by its growth, how certain diseases may be at times communicated through its presence in the milk. It is proved beyond doubt that the control of the bacterial content of milk is the great desideratum of modern dairy management. Exclusion, destruction and retardation should be the watch-words. Keep them out, kill them out, check their growth! How may this be most certainly yet simply accomplished? Cleanliness and sanitation tend to keep them out; live steam, sunlight, sterilization, pasteurization, disinfection, kill them out; and refrigeration serves best to check their growth. In proportion as New England dairymen working privately or associated with others keep their stock, barns and feeds clean and healthy; in proportion to their free use of live steam on dairy apparatus and utensils, the sunniness

of their cow barns and milk rooms, and their free use of ice; in proportion, in short, to their study of economic dairy bacteriology, there will follow the improvement of the character of their dairy products. Such procedure will tend to make their products more uniform, more attractive to buyers and lead to larger consumption.

Some time ago a series of questions touching dairy operations were sent by the dairy division of the United States Department of Agriculture to several heads of creameries the country over. One of the questions was essentially as follows: What one thing, if it could be brought about, would, more than any other, help the dairy industry and dairy products in this country? The overwhelming majority of the replies, not a plurality, mind you, but a majority, stated that more care in the handling of the milk after it was drawn from the cow and before it reached the factory was the one thing needful. The dairyman himself is principally at fault in the matter, a fault which may be remedied by a not unreasonable amount of care. The discouraging feature of the matter, however, so far as it pertains to associate dairying, is that one bad mess of milk drags down the entire lot to its low level; it leaveneth the lump. And not unnaturally the dairyman says, "What avails it for me to use care, to steam my cans, to ice my milk, to dip it, to aerate it, to jacket my cans, to groom my cows, to feed my dry fodder after milking, to ventilate my barn, only to have my milk mixed at the creamery with John Doe's, who never washes his cans, whose cows lie in filth and darkness and whose milk must be well nigh sour when taken into the factory?" John Doe's milk ought to be turned back from the weigh can. The creamery taking John Doe's milk and making on that account a poorer grade of butter ought not to get a good price for it. Unfortunately in many localities, notably in this State, creameries are so thickly located and competition is so keen that generally John Doe can sell milk of pretty tough quality to some one. And, moreover, rivalry between commission men is sometimes sharp enough in certain markets to cause the payment of over-high prices for goods not strictly of a grade meriting them.

There are ways, however, in which any creamery which is in earnest in this matter can grade up to some extent the quality of its milk so far as it relates to bacterial content.

(*a*) It can start a campaign of education among its patrons. The dairy papers preach the gospel of cleanliness; the bulletins of the various experiment stations and in particular those of the Dairy Division of the Department of Agriculture explain the matter from A to Z in such a way that he who runs may read; the very unoriginal remarks I have been making

from this platform to-day are reiterated at institutes, dairy schools, and farmer's clubs the dairy world over. Hold patrons meetings, discuss these things among yourselves, show that care of milk pays indirectly if not directly.

(*b*) Use the alkaline tablet, the rennet and the nose tests on the milks delivered by the various patrons. Use these before the patrons; let them see the differences; let them note the effects thereon of care and of lack of care of milk; let them see how increasing nearness to sourness calls for more alkaline solution, how milks with incipient taints are detected by the curd test and by the nose test, how unerringly the batch of milk which caused that bitter taste, that off flavor, is ferreted out by these secondary tests. Use the alkaline tablet solution from time to time at the weigh can as a warning, as an optical illustration to John Doe that his milk is not being properly cared for. It has worked elsewhere as has the Babcock test in years past to force the indifferent and the careless to better ways. The test may be made by the man at the weigh can as rapidly as he can weigh the milk. Add to his test a little moral suasion and a good backbone and the character of the milk used and the products made can be graded upwards to quite an extent.

I have spent full long a time upon the considerations of manufacture and must now turn to those of sale. It matters not how much or how good one's products, if they are not sold to advantage. Hence markets become very properly the next division of our subject.

(2.) MARKETS.

It will be recollected that I stated at the outset of this discussion that what I did not know about marketing dairy products would fill a book. It is a phase of the general subject with which I have no practical acquaintance. The propositions I am about to advance under this heading are entirely of a second hand nature and any lack of proper stress laid upon this important matter should be attributed to my unfamiliarity with the subject.

It seems right to consider the matter of markets under four sub-headings:

(a.) The general domestic market.
(b.) The private domestic market.
(c.) Foreign markets.
(d.) Is not dairying in danger of being overdone?

(a.) *General domestic market.* The bulk of New England butter and cheese is sold on the general market and competes here with Western made goods. While this is true, each year

a larger proportion of the total New England make is sold in the smaller markets and direct to private customers. There is much to say in favor of this trend of trade, yet there is another side to the question, one which appeals particularly to the dealer. I doubt if I can make this point more clear than by quoting directly and at some length from a letter received by me some time ago from a prominent Boston commission merchant:

"Quotations and prices are established by large markets. The markets are controlled or affected only by the merchandise that constitute important factors in the daily transactions. Our local creameries each year send a larger proportion to their product to the small markets and to what are called private customers. The result is that New England made butter is becoming each year a less important factor in the Boston and other large New England markets. The time is not far distant, when Boston will, like New York, quote prices and establish values in reference to Western goods only and the premiums heretofore paid for Vermont butter will be a thing of the past.

Another way of looking at this phase of the subject is this. More and more each year regular wholesale dealers find that their shippers send only such butter as the creameries cannot sell directly. This causes the supply to be very variable and uncertain. For instance, last week we received about 1200 lbs. from one Vermont creamery that for several weeks had sent nothing. We do not know whether this week we shall receive more, less or nothing, consequently we cannot plan in advance where to dispose of the goods and all our other shippers will have an advantage over this one. Then again we cannot advocate the merits of a creamery when we do not know whether or not we will be able to supply our customer with that particular brand the next time he has occasion to make a purchase. We can always secure from the great West all that is needed and of such quality as is desired. This we cannot do with butter of local manufacture to any such extent. Thus it is for the advantage of the dealer to advocate only such goods as he can feel reasonably certain he can furnish to his customers in such amounts and at such times as they desire. For that reason I would suggest the policy of sending to large markets and large dealers in order that New England produced butter may be the controlling factor in our own markets and in order that those whose transactions establish market values may not be driven to the west for their only reliable source of supply."

I have quoted thus at length because this statement expresses the case fully yet clearly, and deserves weight as a view of the seller. Whether the maintenance of the position of New England butter as a controlling factor in New England markets is a suffi-

cient offset to the immediate financial advantage often gained by direct sales to "private customers" and to small markets, is a question I am not able to decide. I am inclined to think, however, that the latter consideration will usually rule.

(b) *Private domestic market.* This market does not cut much of a figure in the public eye, it makes but little show in the general returns, yet, as has been already stated, is yearly becoming a more and more important factor in New England dairying. The arguments in favor of this market are obvious, and need not be enlarged upon. A good private trade is very much the best way in which to dispose of dairy products. I should not myself feel inclined to worry about Western competition if I had a good private outlet for my products. The average dairyman and the average creamery, however, are not, as a rule, in a position to avail themselves of this chance, a fact which ought to act as a spur to their energies.

(c) *Foreign markets.* American cheese was formerly sold in large quantities in British markets, but the trade has for some time dwindled to relatively small proportions for two reasons: 1st. The manufacture and sale of filled cheese, a fraud which fatted a few dishonest pocketbooks and well-nigh ruined a nation's dairy trade. 2nd. The rapid increase in the volume and in the quality of Canadian cheese. The national law controlling the manufacture of filled cheese, as well as state enactments, will probably aid in the partial recovery of the lost ground, yet our former trade can never be regained. More than this, the fraud we perpetrated has reacted upon us and raised a presumption of suspicion in British minds against all our dairy products, a feeling which it is difficult to allay. American butter has been offered in the English market to but a slight extent until recently. That great consuming nation has relied largely on Denmark, Holland and on distant Australia for its supplies. One of the first acts of the present Secretary of Agriculture was to study English market demands by the shipments of considerable amounts of American butter from many sources, thus working up somewhat of a trade. This action has not only acquainted English consumers with the merits of American goods but has served to teach our butter makers the needs of English markets. Great Britain is naturally prepossessed in favor of her own colonies, while the Danish and Dutch butters grade higher on the average than those of any other country (and it may be stated parenthetically that this is due to the general adoption in these countries of modern methods, cleanliness and particularly of the teachings of dairy bacteriology). This combination is difficult to meet in competition, yet good goods will sell well there. Certain Vermont creameries have already established a London trade, which promises to prove remunerative. In 1893 the United States ex-

ported to England 2,293,000 lbs. of butter, and in 1897, 15,419,600 lbs. of butter, an increase of nearly 700 per cent. The increase in the same time in the exportation of Canadian butter, however, has been even greater.

(d) *Is there not danger of overproduction?* This is a very pertinent question. The old yet ever true answer may be made that while there are always too many inferior goods made, there has not yet been a surplus of the best grades. There is always room at the top. I do not believe there is any immediate danger of over-production. Increase of population more than keeps pace with the increase in the number of cows because of the slaughter of poor animals and calves. The consumption per capita in this country and in Europe of the various dairy products, milk, butter, cheese, cream, milk foods, condensed milk, etc., has greatly increased within the last generation and particularly within the last fifteen years. These two factors, larger numbers of consumers and larger per capita consumption, are, in my judgment, sufficient to take care of the increase in production for many years to come. The increase in the number of consumers has come as a matter of course. The increased consumption per capita, however, has been the direct result of the marked improvement in the quality of the various dairy products; a betterment which has been brought about by the educating effect of constant agitation upon the minds of dairymen and creamerymen. This education from press and platform, from laboratory and class room is resulting in the making of better milk, from which better butter and cheese can be made. It has taught the food producer the money value of palatability and attractiveness.

Let creameries multiply, cheese factories dot the landscape, the milk trains penetrate yet further from the metropolis, the cattle on a thousand hills cover ten times a thousand, and farmers the country over turn to that most rational system of husbandry whose foundation lies in dairying; let all this happen, yet I fear not over-production, the bugaboo of timid souls for generations past, I fear it not so long as a high grade of dairy products is made to tempt the appetite to their larger use.

(3.) THE DAIRY BUSINESS.

I admitted at the outset that in formulating my scheme of division I seemed to have interchanged the locations of cart and horse; also that much which might be said under the head of "Economies of Manufacture" could very properly be considered under the present heading; that, in short, the two were closely alike and not capable of clear differentiation. I made the distinction, however, deliberately, as I wanted under the one heading to lay stress upon the economic side of the prob-

lem, and under the other, that now under consideration, to place the emphasis upon the educational side. The remainder of my appeal will not be addressed directly to the pocketbook, but to the brain. Under this heading I want to consider

(a.) Dairy education.
(b.) The use of the Babcock test on the farm.
(c.) Dairy sanitation.

(a.) *Dairy education.* With dairy papers, dairy institutes, dairymen's associations, dairy schools, dairy bulletins, state and national, with dairy information and education on tap for the asking, all free and most of it reliable and worth having, it does seem as if there was little need for ignorance touching the better methods of dairy husbandry. Yet, if one may judge by conditions as found, there is still lamentable lack of information on every hand regarding the essentials of modern dairy practice. Many dairymen have made great advance along this line, but hosts still stand aloof, and by their actions proclaim that ignorance is bliss. There is still need of missionary work. The great difficulty, however, is how to get at those who will not help themselves, who refuse to read, who will not grade up milk or product, who decline to inquire, who are wedded to their idols, whose sluggishness and indifference affect primarily their own welfare, and secondarily injure that of their neighbor and associates in business. Narrow minded, prejudiced, carping, dissatisfied, suspicious, behind the times, they will not see the light even though it be flashed in their very faces. It is this class of men who growl at the tariff, who complain that dairying don't pay, who think the creamery proprietor a thief, the Babcock test a fraud, to whom it never occurs that the fault lies in their own inability or unwillingness to study their calling and to apply business principles to their work. No sense of their personal responsibility for their ill success appears to oppress them. Instead of seeking to imitate their prosperous neighbor, successful because of the application of modern ideas in dairying, they too often are angry with and jealous of him. They will not see that just as success in other lines of business demands study and application of new economic ideas, dairying, to be profitable, must be studied.

I was amused at correspondence published some months ago in a prominent dairy paper. The writer urged the editor to "let up on those shiftless farmers who haven't intelligence enough to read such a paper nor energy enough to profit by it if they did read it. Publish a paper for intelligent men and let the stupids go." In response to the editor's query whether he ought to stop trying to reach these farmers who refuse to make of themselves intelligent dairymen, he replied that the paper's

course was "not wrong, but blamed foolish." I fear that I have been "blamed foolish" for spending so much time and rhetoric upon this phase of the subject, but this dead load of inertia is to me the most discouraging feature of all, the more so because I see no way of remedying the evil. "Keeping everlastingly at it" will diminish their numbers, but can never do away with the tribe as a whole.

I think I need not remark that I do not fail to appreciate the high intelligence and the business ability of thousands of our New England dairymen. My strictures do not apply to them. Yet I plead even to these to make the widest possible use of dairy literature and dairy education, both for their own benefit and that by their study and their practice they may be "a light to lighten the Gentiles." Many will believe a neighbor's saysso who would laugh at the idea if found in a book. Many scorners of experiment station and farm-institute work are unconsciously practicing the precepts they deride, getting them at secondhand from some townsman. In proportion as we apprehend dairy knowledge, we better our own chances of success and indirectly aid our section to cope more successfully with competition.

(b) *The use of the Babcock test on the farm.* I have already spoken to some extent of the Babcock test. It is now nearly ten years old and may be thought by some to be getting a stale subject. As a matter of fact, however, the Babcock test has more of good in it for dairying every year. It is above every other invention of American experiment station enterprise, a general educator and eye-opener to the dairy world. I do not advocate that every dairyman own and run a Babcock test. Too many have bought them and never used them from the date of purchase to the present day. I do believe, however, that it would be wise for some enterprising young man or woman in a community to own a Babcock outfit and to become thoroughly informed regarding its use. He could then for a relatively small sum test the milk of the cows belonging to his neighbors, and they could thus learn at a minimum outlay of money somewhat of the dairy usefulness of their animals. I am convinced that many a farmer does not test his cows because of his unwillingness to learn to operate the machine. If he had a chance to get his tests made at a small charge, I think the opportunity would be freely grasped. I look to see the time when it will be the common rather than the uncommon thing for the Babcock test to be used on the farm. I believe it has a greater potentiality for good there than at the factory. I believe that it will kill more cows than has tuberculosis, and that each year will make it more clear to the farmers that it is one of the greatest of boons which have been given to our dairymen.

(3) *Dairy sanitation.* I fear that I may be treading upon dangerous ground if I touch upon the relation of bovine tuberculosis to the dairy industry and to Western competition. Yet it seems to me that a word is necessary. I have no hesitation in saying, that eradication is proving the wisest policy in this State. Over a fifth of its entire bovine population has been subjected to the tuberculin test. It has cost but 24 cents per head to test them, and only a small percentage of disease has been found. Whole townships, almost I may say, entire counties have only tested cows therein. Several creameries receive milk from tested cows only and some advertise the fact in the sale of their goods. It undoubtedly helps in competition, and I should persume would raise the price in certain markets. Similarly the knowledge that the animals are kept under sanitary conditions and in cleanliness aids in the sale of the product, especially if it be milk, and if these facts be called to the attention of a discriminating constituency of consumers.

My hearers will recollect that I told them at the outset that I had no startling news to declare, no certain remedy to propose for the ills of Western competition. You now realize full well the truth of my statement. I am not sure, however, that I feel sorry that there is no easy way to meet this rivalry. Were there such, incentives to earnest work would be lacking. There is now every reason to study, to strive, to progress. I have simply emphasized and reiterated those things which I doubt not were known to you before. It may be, however, that in this far too imperfect survey of the dairy situation I have dropped hints which may be of service to some in bettering their practice and enlarging their experience. In some direction perhaps your outlook may have been made more clear by words of mine. I surely hope so, for what are reading, study, practice and experience worth except as guides to future and to better endeavor.

Coleridge, (whose work we of the University of Vermont, in particular, prize, since the foremost American student of Coleridge was in years past our president,) says: "To most men experience is like the stern lights of a ship which illumine only the track it has passed." Let us remove our light of experience from the stern to the prow, let us rather liken it to the head light of an electric car illumining the path before, let us as dairymen walk in the light of past experience, our own and that of others, if it be trustworthy and applicable to our circumstances, to a higher plane of achievement in the varied phases of our calling.

DISCUSSION.

Question—I would like to ask Professor Hills concerning the law passed at the last session of the legislature requiring

the managements of creameries and cheese factories, who pay in accordance with the test, to pay for the pounds of butter made instead of by the butter fat. I wish that he would interpret this law for the managements in order that they may know just what may be expected of them.

Answer. There have been received at the Experiment Station during the past four weeks a great many letters upon this very matter. I have uniformly declined to interpret this law for the reason that I am not myself clear just what the law means. I do not believe, personally, that it is a wise enactment. I think that the intentions of the gentleman who introduced the bill and of the committee which amended it were of the best. It is meant to prevent or to make more difficult the "doctoring" of the test, which is a crying evil in the creamery system. I fear, however, that the hopes of its author will not be realized, that it will not be found difficult to defeat the end sought. I may say, however, that no one will be better pleased than myself if my view of the matter proves to be incorrect. I would advise everybody who is in doubt regarding the interpretation of this law to write to its author, Mr. J. B. Norton of Waitsfield. I am certain that this gentleman will give to all inquiries a courteous response.

I trust that the dairymen understand that the law in question, No. 82, is entirely distinct from No. 81, which is the child of this Association, and fathered by its committee. The latter enactment has to do simply and solely with the character of the apparatus used in creameries and cheese factories for dividend making, and the ability of the operatives of the Babcock test.

Question—What variety of clover would you grow?

Answer—Usually red clover. It is often worth while to have a little alsike mixed with it.

Question—What varieties do not succeed?

Answer—Crimson or scarlet clover cannot be grown as far north as this because of climatic conditions.

Question—Is the oat and pea crop an advisable one to grow?

Answer—Yes, it does better than any other soiling crop with which I am acquainted as a means of helping out pastures.

Question—May it be hayed or put into the silo?

Answer—It may; neither, however, in my judgment is as advisable as using it as a soiling crop.

Question—At what stage should it be cut?

Answer—With the oat-heads in the milk, and the peas in blossom or young pod.

Question—Will there be a rowen crop?

Answer—Not of any account.

Question—Is Hungarian grass a profitable crop?

Answer—As an emergency crop, one for quick growth, when seeding-down has failed or the corn crop is cut down by frosts or other reasons, it does very well. I do not think it makes as good hay or is as good a soiling crop as the oats and peas?

Question—Why is gluten meal better than corn meal?

Answer—Because in the process of the manufacture of glucose the starch is largely removed, while the protein is but slightly reduced in amount. This makes the resulting product richer in protein, which is the nutrient the farmers should buy rather than carbohydrates.

Question—What variety of corn do you consider best for fodder or for silage?

Answer—That variety which will grow the largest amount of food to the acre and come to the early stage of glazing before the frosts. The name of that variety would probably differ more or less in a state like this where the farms vary so widely in altitudes and latitudes. A variety which could be grown in the Champlain valley might not succeed at an altitude of fifteen hundred feet above the sea level. We think that with us the Sanford corn fulfills this condition better than any other.

CREAMERY AND DAIRY PRINCIPLES APPLICABLE IN DAIRYING.

PROF. C. H. WATERHOUSE, Instructor in Dairying, N. H. College of Agr. and Mech. Arts, Durham, N. H.

INTRODUCTION.

As a matter of course, everyone who keeps cows for the purpose of making butter is desirous of making an article that will bring the best price possible, and of making the greatest amount of butter possible out of the milk produced. When the milk is delivered to a creamery it is usually manufactured by those who have been well instructed in the art of butter making, and the result is that, as a rule, a fairly good article is made. Besides this the creamery is equipped with appliances which enable its butter maker to obtain very nearly all the butter contained in the milk ; and by his knowledge of what the general butter market demands, he is able to produce an article which is readily sold.

But the case is different with those who make butter on farms, where by far the greater part of the butter in this country is made. While on some farms excellent work is done and a choice article is made, which brings a fancy price, yet through ignorance of correct methods of manufacture and of the demands of the market and, in many instances, through careless and slovenly habits, the great bulk of farm-made butter fails to bring the price it should, entailing a loss on the farmers of the country which is enormous in the aggregate. It is for the benefit of the latter class that this article is written, with the hope that some suggestions may be given, and some ideas advanced, which will serve to improve the methods of the dairyman and increase his profits.

GOOD MILK.

To make good butter one must have good milk, and this comes only from healthy cows, fed on good, sweet pasture or on good sweet grain and other forage, cows which have pure water to drink and pure air to breathe. Certain obnoxious weeds—leeks, wild onions, rag-weed, and others—give the milk and the butter made from it a decidedly bad flavor ; so

also do damaged, rotten silage, moldy corn fodder or hay, and musty, damaged grain. Impure water has its effect, both on the health of the animals and on the quality of the milk. In many pastures are seen small pools in which the cows stand during the heat of the day to rid themselves of flies. The water in these becomes filthy and is kept stirred up by the movements of the cattle, and where, as is often the case, it is the only water obtainable, the cows are compelled to drink it. This can usually be avoided by fencing the pond and keeping the cattle out. If this water is needed for the cattle it can be drawn out by a pipe laid on the lower side into a trough from which the cows can drink.

In a close, crowded, and illy ventilated stable, where there is too little air space for each animal, the air becomes foul and this affects the milk as well as the health of the animals. The remedy in this case is to provide more room for the stock and better ventilation. The stable should be kept as neatly as possible and the cows well bedded and clean. The utmost cleanliness should be observed in milking. All dirt should be brushed from the cow before beginning to milk, and it is best to dampen the udder and flank of the cow so as to prevent the dust and fine dirt from falling into the milk. The milk should be strained immediately after milking and not allowed to stand in the cow stable any longer than is absolutely necessary.

A good strainer is indispensible, and one of cloth is much better than one of wire gauze. Milk pails should always be made of tin, and the seams should be soldered smooth so that there will be no places for the dirt to lodge where it will be difficult to remove. They, as well as all other dairy utensils, should be thoroughly cleaned every time after using. Tin articles should be first washed in cool then in hot water, and after that thoroughly scalded with boiling water or steam. They should then be dried in fresh air and, if possible, in the sunlight. They will not need wiping after the scalding, as the heat from the boiling water will cause them to dry quickly. In washing them, if hot water is used first, it will cook albumen on to the tin and make it difficult to remove.

In cleaning the butter-bowl, ladle, worker, churn, and any other wooden utensil, they should be first washed with hot water, then scalded with boiling water or steam. They should be aired, but it will not do to have them much exposed to the sun, as that will cause warping and cracking.

CREAMING THE MILK.

When good, clean milk has been secured, the next operation is to separate the cream from the body of the milk. The

old way, practiced by our mothers and grandmothers, was to set the milk in shallow pans with the milk not more than two or three inches deep. I have been through all the successive stages of dairy methods. First, we used to set our milk in common ten-quart tin pans on shelves ; then we had it arranged so that in hot weather cold water flowed around the pans to keep the milk cool. After that, large, shallow pans were used, each one large enough to hold a single milking of the entire herd of twenty-five or thirty cows. Under these pans were water channels, through which in warm weather cold water was run, and in cold weather warm water, to regulate the temperature of the milk. Then the deep cold-setting was used in both "shot-gun" cans and Cooley cans, and finally, for the past five years, the farm separator has been used.

It is undoubtedly true that by the old method of shallow setting as good a quality of butter was made and can yet be made as is produced by any other method, but it has its drawbacks. Uniformly good results can not be obtained, for the reason that the milk, being spread out in a thin sheet, is exposed to the air, so that it is readily affected by atmospheric changes. Whatever may be the reason, very bad effects often follow an electric storm or thunder shower. The shallow pans make more work than other methods ; and the creaming is not so thorough as with the separator, therefore the quantity of butter is less.

As there are many persons who think they are so situated as to make any other method impracticable or who have such a deep seated prejudice in favor of the old way that they cannot be induced to change, it is thought advisable to give directions as to the best manner of proceeding, as determined by the result of long years of practical experience, although the method itself is not recommended.

Milk should be set as soon as possible after being drawn from the cow, whether shallow or deep setting is used. With open setting it must be in a room where the air is pure. A pantry with a door opening into the kitchen is a bad place. The odor from cooking vegetables and meat will surely injure the butter. Many make butter in a cellar because it is cool, but it is apt to impart a musty, moldy smell to the butter. A cellar may be good and cool, and yet be so ventilated as to have pure air ; then it is all right for butter making. To get the best results with shallow setting, the temperature of the milk should not go much above 60° F. At that temperature it can usually stand about thirty-six hours. The time to skim is when the milk has soured just enough to be a little thick at the bottom of the pans and to thicken the cream. The cream cannot be skimmed off when it is thin and sweet without loss. No milk

should be taken with the cream. Cream with milk in it sours much more rapidly than cream with no milk in it. This cream will be very rich and thick and, although partially ripened when taken off, if kept at a temperature of 50° or below, it will be all right if held two or three days before churning. Whenever a new skimming is put into the cream jar or can, the whole should be thoroughly stirred and mixed.

In the winter effective creaming may be had when the room in which the milk is set is very cool, even down near the freezing point. This is accomplished by heating the milk to above 100° F. before setting. The cream will rise very rapidly while the temperature is falling. The warming can be repeated after twelve hours, if the milk is in small pans, by setting over a kettle of boiling water. If large pans are used, such as have been described, the heating is done by running hot water through the water channels beneath the milk. This practice of repeated heating and cooling makes very effective creaming, leaving but little butter-fat in the skim-milk, and the cream is rich and thick. Yet there is danger after the milk has become acid that the coagulation of milk caused by heat will leave white specks in the butter.

DEEP COLD-SETTING.

With this method, the milk is set in cans about twenty inches deep by eight inches in diameter. It should be set in a tank of ice water as soon as possible after milking while the milk is yet warm. The most effective creaming is done when the temperature of the water is maintained at about 40° F., though fairly good work is done when the water is even up to 50° F., if it is allowed to get no higher. When there is a fountain or flowing well or running stream of water continually flowing into and out of the tank, so that the water is constantly being changed around the cans, the warm milk will be more rapidly cooled and the cream will rise more rapidly than if the water is at rest. For this reason cool springs, spring pools, and spring houses are very satisfactory even if the water is up to 53° or 54° F. Deep stone jars or milk crocks may be used as well as deep tin cans. It is claimed that with this mode of setting all the cream that can be obtained will be up in ten or twelve hours. This may be so, though it is doubtful. It is better to let it stand twenty-four hours, for the reason that the cream will be thicker and richer at the end of that time, though it may not measure any more, or even as much, in depth as it would when set only twelve hours.

Setting the cans in cold air will not prove nearly as effective in raising the cream as setting them in cold water, even

though the temperature of the surrounding air is near the freezing point.

With the jars, crocks, and the common "shot-gun" cans, as they are called, the skimming is done by dipping the cream from the top, but with the Cooley cans and many other creamers it is done by drawing the milk off from the bottom and leaving the cream. There is a strip of glass inserted in the side of most of these cans, so that the depth of the cream can be seen. With deep cold setting the cream is always sweet and thin, and where the skimming is done from the top it requires a great deal of skill to dip the cream off without getting some of it mixed with the milk and lost. Much more cream, and consequently butter, is lost in this way than is ever dreamed of by those who practice it. A conical or pointed dipper is the best kind of skimmer for this work. In using it insert the point of the skimmer in the middle of the can and press it down very gently till the cream slowly runs over into it. When it is filled carefully lift it out and empty it; then put it into the can in the same place it was before—that is, in the middle—and repeat the operation till the cream is all off. This work should be done very carefully, so as not to create any commotion in the milk; and even with the best of care some of the cream will get mixed with the milk and lost. Much the best way is to skim by means of a faucet, drawing off the milk rather slowly at the bottom, so as not to create currents in the milk, and leaving about one-half an inch of milk under the cream.

THE FARM SEPARATOR.

By the use of the cream separator a much more perfect separation of the cream from the milk may be had than by any system of setting milk. This is shown by the increased amount of butter made when the separator is used, and also by the lessened amount of butter-fat left in the milk after skimming, as shown by the Babcock milk test. It has been found that by no system of gravity creaming can all the butter-fat be recovered; and usually, under ordinary conditions, a large per cent is lost; while with the separator very nearly all is recovered.

I have been engaged in dairy convention work in New England for several years. At most meetings milk has been tested with a Babcock tester carried along for the purpose. Farmers were invited to bring in samples of milk to be tested in order that they might see the variation in value of different milks, and for the purpose of illustrating and explaining the working of the machine. They were especially urged to bring in samples of skim-milk—that which they thought had been thoroughly creamed—so that the audience might see what the loss was. Report of these tests ranged from 0.80 per cent to 1.60 per cent. This was

in the winter, when there was no difficulty in having the milk cold enough. There is no doubt that in summer, during hot weather, the average loss is still greater. If the separating is done on the farm immediately after the milking, the skim-milk from the separator seldom tests more than 0.10 per cent, and frequently less than that. I now skim to .01 per cent.

As a result of these tests it seems impossible to escape the conclusion that the average loss, where the milk is set in pans, cans and crocks, is three fourths of a pound of butter more to each 100 pounds of milk than where the separator is used. This means, with milk of average richness (3.5 per cent butter-fat), a loss of about 20 per cent of the total product of butter. A herd of cows ought to average, per cow, 5000 pounds of milk per year, and would do so if made up of good animals and well managed; but even if they only averaged 3000, the loss on one cow would be 22½ pounds of butter, and on ten cows 225 pounds, which, at 20 cents a pound, would be $45 a year. It will be seen by this that the loss to the farmers who cream their own milk by a gravity process is enormous in the aggregate. How can any business man succeed and suffer such a percentage of loss? What would be thought of the man who would go on from year to year with a hole in his pocket through which 20 cents would drop out and be lost every time he put a dollar into his pocket. Some men try to console themselves by saying, "It is not all lost, the calves and pigs get the butter." But this is poor consolation, for butter is dear feed, even when the price is the lowest. One cent's worth of oil-meal will do the calves and pigs as much good as a pound of butter. Besides this, the skim-milk from the separator, when it is run through and fed to them immediately after milking, while it is warm and new and sweet, is better feed for calves than skim-milk that is old and partially sour, even though it contains but a hundredth of the butter-fat originally in it. This can be attested by hundreds who are using farm separators.

The cost of hand separators is from $65 to $125 each, according to size and capacity. They will skim from 160 to 400 pounds an hour. Larger sizes with greater capacity are used in large dairies and run with some kind of power. It would seem that no dairyman who manufactures his own milk into butter, having ten cows or more, could afford to be without a separator. One, if properly cared for, will last for years. It is true it takes time, if it is turned by hand, but not as much time as would be taken in setting and skimming the milk and warming it for calves. All except the smallest size hand separators are so constructed that they can be attached to a power. Some use a small gasoline or other kind of engine. A light tread power run by a large dog or some other animal of

like size is very economical. A goat has been found to do remarkably well. Electricity will be used before long.

CREAM RIPENING.

Cream from deep cold setting is cold and sweet when taken off. If it is kept in a room where the temperature is about 60° F. for twenty-four to thirty-six hours it will begin to sour. Each skimming when put in the cream can should be well mixed with what was in before. No fresh cream should be put in the can for twelve to sixteen hours before churning, for if this is done the fresh cream will not be ripened and the butter will not all churn out.

Cream from the separator is warm when it is separted right after milking and has the "animal heat" still in it. It must be aerated and cooled immediately. When the cream is run into "shot-gun" cans the aeration and partial cooling may be done by pouring several times in a small stream from one can to another. A better way is to have a cream cooler made something like a large colander, placed high above the cream can. The bottom of this cooler has a great number of very small holes through which the cream runs in very tiny streams into the cream can, and in that way is thoroughly aired and partially cooled. Setting in cold water will complete the cooling.

The way just described is practiced by a great many with excellent results; but there is a better way if one has the facilities for doing it. Keep the cream by setting in small cans in cold water, or otherwise, at a temperature of 50° F. till twelve hours before the time of churning. Then mix it all together in a vat or can and warm it up to 60° F. Then put in a starter and keep it nearly if not quite up to 60° F. for twelve hours, and when it is afterwards cooled to the right temperature it will be ready for churning. The starter may be some good skim-milk which has been kept at a temperature of 60° F. until it is sour and thick, or it may be some cream already ripened, or some buttermilk from the last churning. Use of the starter an amount equal to about 2 per cent in bulk of the cream; in other words, one quart of the starter to twelve gallons of the cream. Another form of home-made "starter" which has been highly recommended is made as follows: Take fresh milk, secured in a perfectly clean way, from a healthy, well-fed, fresh milch cow. Set this milk in ice-water and expose only to pure air for twelve hours, or pass it through a separator, and keep the skim-milk at a temperature of 60° F. long enough to lopper. Do not disturb the coagulum until ready for use. Then skim off the top, stir it carefully, and strain through a fine mesh into the cream, in the proportion already stated.

One of the most difficult things to determine is when the cream has the proper ripeness to be churned, so that uniform results may be obtained and one churning be like another. As an aid in this matter, acid tests have been invented for testing the acidity of cream during ripening, "to trace the progress of its souring and show whether the fermentation should be hastened or checked in order to have the cream in a certain acid condition and ready for churning at a given time". These acid tests require experience and skill for their successful use. A skillful and experienced butter maker is able to judge closely as to the right condition of cream for churning by its appearance. But this is a matter which it is impossible to exactly describe in words.

THE CHURN.

The best churns are those with no inside fixtures and which revolve, like the barrel churn, square box churn, rectangular churn, &c. These "bring" the butter by the concussion of the cream in falling from one side to the other as the churn is revolved. A quite common mistake is to get too small a churn. It should never be filled more than half full of cream. One-third full is better, because the cream has a better chance to fall. Before putting in the cream the churn should be scalded with hot water and then rinsed with cold water.

CHURNING.

The cream should be brought to the right temperature for churning before being put into the churn by having it surrounded by cold water if the temperature needs to be lowered. The churning should be done at as low a temperature as possible and have the "butter come" in a reasonable time, say in from thirty to sixty minutes. The colder it is churned the less butter-fat will be left in the buttermilk and the more perfect will be the granules of butter. It is impossible to lay down any exact rule as to the right temperature; that will have to be determined by trial, each butter-maker for himself. Ordinarily from 54° to 60° F. is right, but sometimes it needs to be much lower and sometimes, possibly, a little higher. At the dairy tests at the World's Fair in 1893, where expert buttermakers made every effort possible to do exhaustive work, the Guernsey cream was churned at times as low as 43°, while the cream from the other herds was churned 8° to 10° F. higher. The temperature at which cream should be churned depends in some degree on the breed of cows, the individuality of certain cows or certain families of cows, the period of lactation, the feed of the cows, and, more than anything else, on the thickness or richness of the cream.

The temperature of churning needs to be higher when cows are in an advanced stage of lactation; also when they have dry feed in winter, and when cotton-seed meal is fed to any extent. When cream is rich in butter fat, such as can and ought to be obtained with the separator, containing from 30 to 35 per cent. of fat, the temperature of churning can be low, usually from 52° to 55° F. This is the way to get the most exhaustive churning; the amount of buttermilk and the per cent of butter-fat in it will be small at these low temperatures. With deep cold setting the cream will be much thinner, containing considerable milk, and therefore the per cent of butter-fat will be low, and it be useless to try to churn at a low temperature. In such cases from 60° to 62° F. will be necessary.

Cream from shallow setting, if it is skimmed pretty clear of milk, can be churned at a somewhat lower temperature than that from deep setting. Sometimes the cream from shallow setting, especially if the process of heating and cooling has been resorted to in raising the cream, is so thick that it will not fall when the churn is revolved. In that case it must be diluted. Water is better than milk as a dilutant.

The churn should be revolved at a speed that will produce the best concussion. With a forty gallon box or barrel churn this will be about fifty revolutions per minute; with a smaller churn somewhat more speed is required. One can soon learn to tell by the sound when the cream begins to break. Then close watching is needed, so as not to churn it too much. The churn should be stopped when the granules of butter are somewhat smaller than wheat kernels. Use water enough to make the butter float well, so that the buttermilk can be drawn off. Then revolve the churn a few times. Draw off the buttermilk through a hair sieve, so as to catch the granules of butter that escape from the churn. Then wash the butter with pure water at a temperature of 50° F. or below. This will harden the granules so they will not so quickly mass together. Wash it twice, each time using ten or twelve quarts of water to every twenty pounds of butter, and revolve the churn a few times. Do not wash it more, nor let the water stay on a great while at a time, for this will be likely to wash out the flavor and aroma for which fine butter is prized.

I am aware that this is contrary to the instructions given by many teachers on this subject. They advise washing more, saying that it should be washed till the water runs clear. But numerous experiments where the butter has been submitted to the judgment of experts, seem to prove conclusively that the market yet demands some of the flavor that is found in butter which has not been excessively washed.

WHITE SPECKS IN BUTTER.

Mottled butter and "white specks" are sometimes confounded, and by some are considered the same, but there is a difference. Mottled or streaky butter has been explained as being caused by an unequal distribution of the salt; but "white specks" have a different cause or causes. Sometimes, when the milk is set in shallow pans, they result from the cream drying on top, so there are small portions that are so hard that they do not churn into butter. These particles do not take the color like the rest of the butter, and the "specks" are thus caused. This may be remedied by carefully straining the cream when it is put into the churn.

Another cause of "white specks": When milk is skimmed off with the cream, as is usually done in the case of deep cold setting this milk settles to the bottom, gets overripe, and forms a curd, which will be so hard as not to break up in churning and will not run off with the buttermilk, but will remain with the butter as "white specks" or "flecks", as they are sometimes called. This can be remedied by not letting the cream stand so long before churning, or by frequent and thorough stirring of the cream during the process of ripening. Those hard white particles can also be taken out by straining the cream.

Mottled, streaked, or speckled butter will not sell well in market; therefore it is the part of wisdom to guard against such conditions.

COLORING BUTTER.

Butter should be colored to suit the person for whom it is intended. The general market demands that butter should have a color, the year round, about like that of grass butter in June. Doubtless any of the standard butter colors are good. The coloring matter should be put in the cream after it is all ready for the churn. When the butter would be nearly white if not colored, as is often the case in winter, about a teaspoonful of color is usually needed for eight pounds of butter. In summer in times of drought and in the fall, when cows are fed partly on dry feed, some coloring may be needed, but very little. One will soon learn by experience how much to use. It is well to be cautious, as it is better to have too little color than too much.

SALTING AND WORKING BUTTER.

Good, fine dairy salt should be used, and never the common coarse barrel salt that is used by many. The salting may be done in the churn when the butter is in the granular form, if it is a box or barrel churn. The salt can be sifted on the but-

ter by putting on a part, then revolving the churn half way over, thus making the butter fall with the salted side down, then sifting on the rest of the salt. Then revolve the churn a few times, after which the butter can be taken out and worked on a butter worker. This is the way most commonly done, but it has its difficulties. The trouble is to have just the right amount of salt in the butter when it is finished, so as to have the product perfectly uniform as to saltness. The exact weight of the butter in the churn is not known, though this can be closely estimated, but it is impossible to tell how much water the butter contains, while in its granular state. This water must be all salted and a portion of it will run off in the form of brine when the butter is worked. The finished butter should contain about three-fifths of an ounce of salt to the pound. To insure that amount, at least an ounce and a half of salt must be put in for each pound of butter in the churn, and yet, do the best we can, it will be found that two successive churnings are seldom salted just alike. I have found that a better way to insure uniform salting is to take the butter out of the churn, drain and press out a part of the water on the worker, then weigh the butter, and salt one ounce to the pound and work enough to get the salt evenly incorporated. Some more water or brine will run off in the working and leave the butter salted about right. In this way it will be found that one churning will be salted very nearly like every other churning.

There are several different kinds of butter-workers used by dairymen but in my opinion none are better for home use than the common lever pattern.

SHALL BUTTER BE WORKED ONCE OR TWICE?

The object of working butter is to get the salt evenly distributed and to expel a portion of the brine. When it is worked but once the butter-maker thinks he has worked the butter enough and packs it immediately. There is, at that time, no way to tell whether the salt has been evenly distributed or not. A few hours afterwards he draws out some of the butter with a trier, or cuts it with a ladle, and finds it mottled, which will seriously affect the selling price. He knows the cause is unequal salting; that the portions which have salt have changed to a deeper yellow, and the unsalted portions have remained of a lighter color. With the next churning he is determined to remedy this and be sure to work enough. The chances are that this time it is worked too much so that the grain is injured and the butter has a greasy appearance. But after much practice and the exercise of good judgment and care, these errors can be avoided to a great extent and a fairly uniform and even product produced.

In my opinion it is better to work butter twice instead of once only. The first time it should be worked just enough to mix in the salt. Then for one hour it should be left on the worker or in some other place where the temperature is from 60° to 65° F. so that the butter will remain in the right condition as to hardness to work well. This will give time for the salt to dissolve and also time for it to change the color of the butter with which it comes in contact. Then it should be worked just enough to obliterate the streaks and mottles. This second working expels some more of the water, for the salt has had time to draw the moisture together in drops, and it is worked out, thus making a drier butter containing from eighty-three to eighty-five per cent of butter-fat. Such butter will be firmer and better and more satisfactory to the consumer than it usually is when worked but once. Immediately after the butter is worked it should be packed in neat, clean packages, or put up in such form as is required by the market to which it is to be sent. If tubs are to be used, ash or spruce is to be preferred, and they should be well soaked before packing the butter. If other wooden packages are used they should be lined with parchment paper. This will prevent the butter tasting of the wood.

MAKE BUTTER TO SUIT THE CONSUMER.

One thing should always be borne in mind by the person who is making butter to sell. The butter is for somebody else to eat and it is for your interest to make it to suit them whether it just suits your taste or not. Habit has a great deal to do with our likes and dislikes. You may have become accustomed to sweet-cream butter ; if so, you probably like that best. Or, you may have got used to eating butter made from very ripe cream, and the butter not washed to expel the buttermilk, causing it to have a very decided flavor and taste, and so you look upon fine, delicate flavored butter as insipid. Or you may like little or no salting or high salting ; light color or high color. But all of this is of no consequence. It is no matter what you like. You want to make it suit your customer and you want your customers to be those who are able and willing to pay a good price for what suits them. If the customer wants sweet-cream butter, make it ; if unsalted, make it so ; if he desires it high salted, salt it high, and so on. Always make it the same for the same customer. They are getting tastes formed which you can make it profitable to gratify. It is not the province of the maker of dairy butter to try and educate the tastes of people who buy butter, but rather to cater to their tastes when he finds out what they are. If one is making butter to put on the general market, he wants to make what the

market demands and will pay the best price for. The best way to learn the market demand is to have the butter inspected by an expert judge who is a dealer and knows what takes best in the market. Ask him to criticize it and tell you just what he thinks of it; and don't get angry at what he tells you, but try and profit by what he says. The object of this article is to help farmers to make such butter as the best paying customers in the general market demand.

BACTERIA IN MILK.

S. C. Keith, Jr., Boston, Mass.

Ladies and Gentlemen :

Many people are under the impression that the bacteria are bugs and animals of a size only a little smaller than can be seen with the naked eye, and that they possess digestive organs, legs, etc. Many also think that these so-called bugs are always of such a nature that we should give them a wide berth. As a matter of fact, however, the bacteria are not animals but are very minute plants ; in fact, they are the smallest of all living things and their images require to be magnified more than five hundred times before they can be seen at all. And in order to see them well, we must view them with a microscope having a power of from one thousand to fifteen hundred diameters. Many millions of them can easily be taken up on the point of a needle at one time and it has been estimated that one hundred times the population of London could be spread in a single layer over a square inch of surface without crowding. The bacteria have very simple forms and can all be classified under three heads—ball shaped, rod shaped and bent or spiral shaped. They reproduce by simple division, one bacterium gradually splitting into two, these two again making four, and so on. In this way under favorable conditions from a single bacterium millions may grow in a few hours, as it takes only about a half an hour ordinarily to complete one generation.

I can very well demonstrate this method of multiplication by means of a sausage, which might well represent a giant bacterium of the rod-shaped variety, and at the same time convey to your minds a clearer notion of their infinitesimal size by comparing the sausage bacterium to some known object magnified correspondingly. If, for instance, I should be the object in question, my height would be some sixty miles, and the giant hand holding the bacterium the size of a sausage would be three miles wide. By twisting the sausage so that the envelope becomes narrowed at a point near the middle of the sausage and by twisting until the division is complete, we very nearly represent the division taking place in the bacterium cell, only in the case of the bacterium the division into two parts takes place by simply drawing together instead of the twisting process as I have shown you here. It perhaps might be represented more nearly by tying a string around

the sausage until it becomes divided into two parts; if then each half of the sausage so divided could grow in length to the size of the original sausage and then these could divide so, making four sausages, etc., we should then have a very clear idea of just how the bacterium multiplies.

Although the science is new, about one thousand species of bacteria have been described, but only about fifty of the species known to-day are capable of producing disease either in man or beast; the remainder are either harmless or even useful and necessary to our very lives. Comparatively there are really as few dangerous bacteria in the germ world as there are poisonous plants in our woods.

The bacteria were first seen about two hundred years ago by a Dutchman, Leeuwenhoeck, but it was not until 75 years ago that they were studied at all in detail, and then only imperfectly. The modern science of bacteriology really began with Pasteur, since he was the first to prove that the bacteria were the cause of decay and certain diseases, and not the result of them as many had affirmed before him. Robert Koch, to whom we are indebted for our present knowledge of consumption from a bacterial point of view, also gave us a method of separating the species of bacteria which enables us to cultivate them in a state of purity. His method is based on the fact that only one kind of bacteria result from the growth of a single bacterial cell. As I shall have occasion later to show you the result obtained by this method I will explain it in detail. Supposing, for instance, that we wish to know the number and kinds of bacteria in a drop of water. The way we proceed is to introduce the drop of water into a tube of melted culture gelatine, itself bacteria free, and pour it into a covered glass dish where it is allowed to solidify in a thin layer. The bacteria, of course, will be distributed in the gelatine and after a few days an examination will show it to be covered with specks of varying appearance. These specks are colonies of bacteria which have resulted from the growth of those introduced in the drop of water. Obviously the number of specks will represent the number of bacteria originally introduced with the water, as each spot had resulted from the growth of a single germ. To determine the species of bacteria of the colonies, however, is more difficult as it depends on the manner in which they affect certain culture media when grown in them. This, together with their microscopic appearance, is used to determine the species in question. Considerable experience and time are necessary, however, to carry this out, and it is of too technical a nature to further describe it here to advantage.

The relation of bacteria to oxygen, however, is important for us to know, since many bacteria thrive best when living in contact with an abundant supply of air, while others, and

there are comparatively few of these latter, find their best development in the absence of air, in fact there are some even that absolutely refuse to grow at all when even a trace of air is present.

Milk as drawn from the naturally healthy cow is practically free from bacteria, yet unfortunately it is not destined to remain so. The sources of the bacteria in the normal milk are more numerous than one would naturally suppose at first. The so-called fore-milk seems always to contain the germs of souring, and should be rejected if it is desired to obtain a milk as nearly free from bacteria as is possible. However, more serious and greater sources of bacteria arise from the introduction of hay-dust, hairs and manure into the milk. With regard to this latter it is commonly thought that excreta can be removed from milk by straining it through cloth, but as a matter of fact this is not the case, for about one-half of cow-dung dissolves directly in the milk, and at the same time millions of fecal bacteria find their way into it, and growing there, produce very unpleasant odors and tastes.

As I have previously said, it has long been known that milk as it is secreted in the cow's udder is practically if not entirely sterile. Some ten years ago Prof. Sedgwick and Mr. Batchelder succeeding in drawing milk free from bacteria by the use of sterilized milking tubes. Last spring I tried a similar experiment in a somewhat different manner. I had an apron made so as to cover the entire sides and flanks of the cow, only allowing the teats to protrude. By this means all hair, dust, etc., were prevented from falling into the milk when it was drawn. The hands and teats were carefully washed with corrosive sublimate solution and then about a dozen test tubes that had previously been sterilized were successively filled from the same teat. Portions of these samples were at once used for making gelatine plate cultures and then the remaining milk was placed in an incubator at 98°F. These tubes were examined daily and any change in the milk noted.

Tube I—Containing the fore milk coagulated at the end of two days, and the corresponding plate culture showed it to contain 1160 bacteria per cubic centimeter.*

Tube II—Remained sweet four days and showed 180 bacteria per c. c.

Tube III—Sample taken after a pint had been drawn, remained sweet six days and showed 20 bacteria per c. c.

Tube IV, Etc.—Several successive tubes taken by sterilized milking tube, remained good for seven days, but showed no colonies on plates. (Probably a few bacteria got into the milk, but

*About a quarter of a teaspoonful.

so few that they escaped detection until incubated, when their presence finally became known by the curdling of the milk.)

It will thus be seen that even without milking tubes it is possible to draw milk which is practically bacteria free, if the dust, hair, etc., are kept out.

At the same time that the above milk samples were taken, I exposed a gelatine plate in the stable for two minutes and found by the colonies developing on it that during that time several thousand bacteria had been deposited thereon with the settling dust of the stable.

City milk contains on the average from seven to ten million bacteria per cubic centimeter, and we all know that the keeping quality and healthfulness of such milk is not all that it should be, for although when kept cold no apparent change takes place, yet as Prof. Sedgwick and Mr. Marshall have shown, there is a slow yet constant increase of bacteria that ultimately give rise to putrefaction, even though no souring change occurs. If the same milk, on the other hand, had been allowed to remain warm even for a short time, the lactic acid bacteria would have developed and the milk would have soured. So although bacteria may be retarded in their growth by icing, yet, iced or not, either putrefactive bacteria or lactic acid bacteria are bound to develop.

Many of the aerator advertisements claim that aeration will remove bacteria from milk and so prevent its souring, but the real benefit derived from aeration comes from the fact that the milk being charged with air favors the growth of other than the souring bacteria which thrive best when growing without air. Thus while aeration undoubtedly prevents souring to a great extent, yet on the other hand it favors the growth of perhaps the less desirable putrefactive bacteria, besides at the same time being likely to introduce large numbers of bacteria from the air as it comes in contact with the milk, especially if the aerator is placed in a stable or tie-up, as is commonly done by the average farmer.

With Messrs. H. P. Hood & Sons I have been enabled to visit a few dairies during the past year, and to attempt to trace the cause of the many high numbers of bacteria we found in the milk from them as received in Boston. With the dairies in question, the following was the method of procedure. We first made bacterial analyses each week until we knew what to expect from any given dairy that we were investigating. With this knowledge gained I visited the dairies and sought to find out the cause of the excessively high or low number of bacteria I had found, and in nearly every case was able to discover the reason.

The following tables give a general idea of the bacterial content in the milk found in ten dairies examined. The different num-

bers given show the number of bacteria per c. c. in the milk, and in every instance examinations of the milk took place for several successive days. It will be seen that dairies number 1, 7 and 9 showed very large numbers of bacteria, and a visit to the farm in each of these instances showed unsanitary conditions and that poor care had been taken of the milk.

Dairy number 3 was interesting, not on account of the high numbers found, but for the fact that in each of the three examinations numerous bacteria were found in the milk, which gave evidence of the milk having been too near the pump. An examination of the well water on this farm proved the correctness of our supposition from the fact that it showed a pure culture of the bacteria we had found in the milk. The farmer was warned about rinsing his cans in this water and seemed surprised that we are able to tell him that his milk had been watered and even more so when we were able to tell him whence the water in question was taken.

Dairies number 2, 4, 6 and 8, while showing comparatively large numbers as it would appear to the layman, yet may be considered as model dairies in every respect, and from a bacterial point of view the milk has a small bacterial contamination.

Dairy No. 1.		Dairy No. 2.	
7,300,000	numerous putrefactive bacteria.	10,000	mostly souring bacteria
225,000		970,000	
16,330,000		30,000	
10,000,000		10,000	
24,500,000		10,000	
		1,000,000	
		10,000	

No. 3.		No. 4.
3,410,000	green liquefing bacteria	15,000
4,550,000	"	300,000
3,600,000	"	970,000
		40,000
		65,000

No. 5.	No. 6.
135,000	15,000
10,000	35,000
60,000	900,000
100,000	240,000
50,000	30,000
100,000	
600,000	
20,000	
250,000	

No. 7.	No. 8.
15,750,000	330,000
3,720,000	330,000
4,000,000	60,000
23,800,000	20,000
9,500,000	1,730,000
18,200,000	90,000
No. 9.	**No. 10.**
12,440,000	20,000
9,560,000	135,000
21,700,000	1,070,000
3,600,000	400,000
6,860,000	30,000
15,000,000	50,000
	120,000
	1,100,000

It will also be seen by referring to this table that on the whole a bacterial analysis of a dairy reveals its biological character, and that two tests of the same dairy on different days afford an almost perfect indicator of what to expect of its condition.

In order to note what variation was to be expected in a number of cans from the same dairy and thus to see what value could be given to one test, I analyzed nine cans of the same day's milk with the following result, which seems to indicate, as did the analyses of milk of different days, that a very fair idea is to be had based on one analysis.

55,000	220,000
420,000	50,000
750,000	100,000
270,000	725,000
700,000	

I have found, as have Sedgwick and Marshall, that the bacteria and acidity of milk have no fixed ratio. In other words milk often shows high numbers of bacteria without of necessity showing acidity. On the other hand, however, as would be expected, I have never found acidity without large numbers of bacteria.

By means of peculiar flavors produced in milk by most lactic acid bacteria, expert tasters are able to detect the acid before it is developed to any considerable extent. In other words the taste of acidity is preceded by a peculiar flavor which enables expert tasters to detect such milk before it is revealed by testing with standard alkali solutions. The minimum number of bacteria in milk of this character is about 20,000,000 per c. c.

In many cases also I find that that milk thrown out by tasters does not contain high numbers of bacteria ; this arises from the fact that often the cow eats something that renders the milk of

bad flavor or the milk has been allowed to stand in some place where it has absorbed foul odors.

I have since determined the number of bacteria in milk from several hundred dairies and find on the whole that they are rather lower than could be expected in view of the numbers present in most of the city milk.

In one lot of sixty-seven dairies examined during the summer, 12 per cent showed less than 100,000 bacteria per c. c., 50 per cent 100,000 to 1,000,000 per c. c., 25 per cent 1,000,000 to 5,000,000 per c. c., and 13 per cent 5,000,000 and over per c. c.

As I have said, however, there is some milk passed by the tasters that contains large numbers of bacteria. It is my opinion that if dairymen did not of necessity have to mix the milk from different dairies to even up the amount of butter fat present, they would be much better off as regards the keeping quality and healthfulness of the milk, since a single can of poor milk will spoil a dozen cans of the best when mixed with them.

Another source of the bacteria in city milk is the can in which it is delivered. Most milk cans are washed with hot suds and rinsed in water. I have examined some fifty milk cans to determine to what extent they may infect the milk and find on the average there is a sufficient number remaining in a washed can to seriously affect the keeping quality of milk placed in it. The method of examining cans was to place 100 c. c. sterilized water in a can, shake it up thoroughly and empty back into a bottle. In this way a part of the bacteria were removed with the water and their numbers could be estimated by the usual process of plating.

The following table shows the numbers of bacteria found per c. c. of water for rinsing. A large proportion of the bacteria found were of the lactic acid producing type.

1	68,000	9	800,000
2	560,000	10	568,000
3	13,000	11	406,000
4	728,000	12	301,000
5	798,000	13	377,000
6	2,240,000	14	665,000
7	110,000	15	26,000
8	180,000	16	332,000

This means that if a quart milk-can like the above were filled with sterilized milk, the milk would have added at once from 2,600 to 224,000 bacteria per c. c., which number alone would be large enough to cause it to change, if the milk received improper care afterward, as is often the case.

In butter-making, however, some of the bacteria are useful rather than detrimental and play an important part in the fermentation of cream previous to churning. Formerly it was

a common practice to churn the cream sweet or even to churn the milk, but it was found that such butter lacked the keeping quality and aroma found in butter made from ripened or slightly soured cream. Working on this principle the process of ripening cream has to-day become an art and the most successful butter-maker is the one who most thoroughly understands how to control this process properly. With the advent of the centrifugal cream separator the process was more easily controlled, since it gives the butter-maker cream directly from the milk without its aging, so that the fermentation is under his control from the start. There are many creameries to-day, however, that are working under the disadvantage of gathered cream systems where the cream is collected from the farmers either daily or every other day. In this case oftentimes the cream is all ready ripened or is over-ripe before the butter-maker gets it, thus making it impossible for him to turn out a first-class product. The amount of acid developed in cream during the ripening process is important, too little rendering the butter of poor keeping quality and flavor, while an excess tends to produce a butter that turns rancid quickly. Butter-makers have found that about 0.5 per cent lactic acid in the cream develops the best aroma together with the desired keeping quality. It is the custom in some creameries to use a so-called starter for the cream, and one of the common forms of such starter is made by saving out a portion of milk from a particularly neat farmer, letting it sour by itself and then adding this as a sort of leaven to the fresh cream. Others have found that this process is on the whole is a good practice, yet sometimes it fails them, and so consequently have adopted a commercial pure culture of bacteria that has been selected for that purpose. Dr. V. Storch of Copenhagen, Denmark was the pioneer in using pure cultures. Believing that acid producing bacteria were the cause of ripening he selected from ripened cream such cultures as seemed desirable and used them for seeding cream to produce the correct fermentation. Later Dr. Weigmann of Germany, worked along similar lines and isolated several cultures which are now to be had in a powder form and are used in the same way as the Storch culture. Some three years ago I became interested in the subject of cream ripening and isolated a form of bacteria which seems to have given better results than any of the foreign cultures we have tried. This culture is distinct from the acid bacteria variety of Storch and Weigmann, and is intended to be used for flavor production alone, the necessary acid being developed from the naturally contained lactic acid bacteria of milk. I have refrained from putting up our culture in any way different from that first adopted by me in 1893, which is to introduce the culture

directly into a sterilized bottle which is then quickly stoppered with a sterilized cork. Examination of cultures put up in this way and held for periods of six months to one year, fail to reveal any but the original organisms introduced, which is in distinct contrast to cultures put up in the powder form where they must necessarily be exposed to the air sooner or later and thus become contaminated with foreign and sometimes harmful micro-organisms.

SUMMARY.

1. Milk in its natural state is free from bacteria and consequently will keep indefinitely.
2. Fore-milk contains a few bacteria and should be rejected.
3. Milk is seeded with bacteria from dust, contact with improperly cleaned utensils, water, etc.
4. Bacterial analyses of milk may be depended upon to indicate the care with which it has been previously handled.
5. A large part of the milk analyzeds hows it to have had proper care.
6. Cooling milk does not entirely prevent growth of bacteria, but prevents souring.
7. The cans of the local dealers into which milk is put add a considerable number of bacteria to the milk.
8. A bacterial examination of dairies is a valuable assistance in improving the condition of a milk supply.

Question—Does pasteurization improve milk and cream for butter-making?

Answer—In many ways butter made from pasteurized cream is preferable to that made from raw cream. This is especially true for butter intended for storage or shipment to distant points, as the keeping qualities derived from pasteurization are such that the butter undergoes but little change for some time. The flavor of the butter made in this way is usually not so pronounced and fragrant as with the raw cream product and for that reason does not perhaps suit the home market demand as well, yet in the long run a much more uniform and higher grade article is produced.

It has been alleged by some that the grain or texture of the butter is somewhat injured by pasteurization. Whether this is so or not I am not in a position to say, but the chief drawback to its more general adoption seems to be that what is gained by the process does not compensate for the extra expense and trouble incurred.

Question—Are the germs found in ice more injurious to the creameryman than those in the air, and if not, would you advise the cooling of cream by placing ice directly in the vat?

Answer—Under ordinary conditions, allowing that the ice was taken from a good source, I should say that the effect of the contained bacteria would be far less than that of the air bacteria falling into the cream vat. If one is sure of an ice, I see no reason why it should not be used in moderate quantities directly in the cream vat for cooling purposes.

Question—Could you tell us the number of germs in a pound of ice?

Answer—The number of bacteria found in ice varies considerably from the fact that the bacterial content of the water from which the ice is formed is subject to very great variation. For instance, Boston water has about 100 bacteria per cubic centimeter, while water from the Merrimac river shows 5,000–10,000 bacteria per c. c. It follows that ice from these two sources must also vary. I may say, however, that as a rule ice shows fewer bacteria than the water from which it was produced and in many instances the bacteria are so reduced in number that it could be called for all practical purposes sterile or devoid of bacteria.

CHEESE MAKING.

THOMAS J. DILLON, Prince Edward Island.

The cheese-maker, if properly qualified, is a very important man in the community. A good cheese factory brings in a lot of money, and a factory will not be successful unless the maker is competent. He should, therefore, be a man of well-trained judgment, and excellent natural ability, should be well informed, and have a good knowledge of human nature, beside being thoroughly posted in his business.

THE MILK.

In most professions the operator has the raw material in about the same condition from day to day. Not so with the cheese-maker. His raw material—the milk—is never the same. He will not get two vats exactly alike, even on the same day, and to make a uniform cheese from the different qualities of milk requires good judgment, and great care. Then, too, he has the best interest of the patrons of the factory to consider. Some patrons will take proper care of their milk, and see that it is always sent to the factory in good condition, while others will be careless, allow their cows to feed on what they should not, or are not as careful about milking or handling the milk as they should be and when it arrives at the factory, the maker finds it is not fit for first-class cheese. It is his duty to refuse to accept such milk, whether it be from the largest patron, or the most influential man in the company, just the same as if it were from the smallest patron or the meanest. So you see the cheese-maker needs to be a just, upright, impartial man, and he should be courteous also. If a can of milk smells badly, it is not necessary to say it is rotton, vile, etc., etc. Such expressions are apt to offend the owner, and drive him away from the factory, whereas, if he were carefully advised that his milk was "off" in flavor, or quality not right, he might get interested and become one of the best supporters of the factory. The cheese-maker should impress the patrons with the idea that their interests and his are mutual, and as he knows more about milk and how it should be handled than they do, should try and lead them to a better way, and not attempt to drive them. A cheese-

maker with intelligence, tact and good judgment will build up a business where one lacking those qualities will fail. Thus you see the success or failure of a factory depends very largely on the cheese-maker.

A cheese-maker should be a bit of an engineer, understand how to care for and manage his boiler and engine so as to get the best out of them for the fuel consumed, and have them last a long time. There are times, too, when he needs to be very quick in his decisions and actions, and others, when he needs to exercise great patience. So much by way of leading up to my subject. Now for our talk on practical cheese-making.

MAKING.

After the factory has been fully equipped, with the weighing can on a good set of scales, a nice clean strainer on a clean vat and scales properly balanced, we are ready for the milk. The manager of the factory should take his place on the weighing stand, examine each can of milk as it is emptied into the weighing can, refusing any that will not make first-class cheese. Put a sample in the composite jar for the Babcock test, for all milk should be paid for according to the fat it contains. Weigh carefully, and credit the patron with every pound he delivers. As the milk is being weighed in, the temperature should be gradually raised to 85 degrees Fahrenheit. The milk should be stirred gently to keep the cream from rising, and to insure an even temperature. When the vat is filled, if the cheese is to be "colored," add the necessary amount of coloring matter, and stir well so as to mix thoroughly. Do not apply the rennet for ten or fifteen minutes after the steam has been turned off and coloring added, unless the milk is over-ripe. When milk is in proper condition, add sufficient pure flavored, reliable rennet, diluted with cold water, to coagulate it fit for the knife in thirty minutes. Then cut first lengthwise with the horizontal knife, commencing before the curd is hard, and moving very carefully so as not to disturb the mass. As soon as cutting lengthwise with the horizontal knife is finished, cut crosswise with the perpendicular knife, and then lengthwise. The curd will then be in square pieces about the size of dice. I would much prefer having them about one-quarter smaller. We in Canada are badly in need of a better class of curd knives than we have at present. They are coarse, thick-bladed, ugly things, that bruise the curd instead of cutting it. If the milk has been in proper condition, and the curd not liable to develop acid too fast I would turn the curd with the hands very carefully, going slowly twice round the vat. Then loosen any particles that may be sticking to the sides or bottom of the pan, then turn the curd over carefully with the hands, going twice round the vat again

before applying the heat. If curd is roughly handled at the start, the fine glossy texture so desirable in a cheese, will be destroyed, the development of acid will be much slower, and the loss in yield greater, so it pays in more ways then one to be very careful while the curd is soft. After applying the heat, stir constantly, keeping all the particles of curd separate, raise the temperature gradually, or at the rate of, say, two degrees every five minutes, until the curd is cooked, which should never be above 98 degrees even on a wet day when the humidity is great and 96 degrees when the air is dry and clear. If the knives were made so as to cut the curd into smaller pieces, I believe a lower temperature than 96 degrees would give a richer and more creamy flavored cheese. A cheese made from an over-cooked curd is seldom nasty, but never nice.

After the temperature has been raised to the desired degree, if the acid is developing rapidly, I would run off the whey until there is just sufficient to cover the curd, which I would stir so as to expel the whey, and get well and evenly cooked. When the curd is fairly firm, and shows 1-8 inch of acid by the hot iron test, the whey should be drawn off, the curd dipped into a sink, and stirred until fairly dry. One of the finest points in cheese-making is to know just how much moisture to leave in the curd at this stage. Of course if the acid is developing fast, the curd will need to be stirred considerably drier than if it is developing slowly.

Spread the curd evenly over the racks in the sink, about five inches deep, being careful to have it the same depth at the sides and ends as in the middle. After it has matted, cut with a thin bladed, dull pointed knife into strips about eight inches wide, turn over, doubling the pieces at the ends of the sink. In about fifteen minutes cut through the center, and turn again, putting the outside ends in and doubling if the acid is developing slowly, but if fast, do not double. Sometimes it is necessary to pile. Every time when turning put the pieces that have been on the outside, to the center, so as to insure an even temperature. Remember that an even temperature of all the curd is important. When sufficient acid has developed, which may be one inch by the hot iron test, on a close sultry day, with a fast worker, to two inches on a clear, cool day—cut into pieces about five inches square, which leaves it in good shape for the Harris curd cutter—the one I have found to be the most economical and do the best work. I would not use any cylinder mill I have ever seen, except the McPherson, which does very good work, but the Harris is the handiest, best and cheapest.

After the curd has been milled, stir well so as to check the acid and keep it in proper condition for salting. When it has

developed a nice cheesy flavor, cuts smooth and close, shows butter when squeezed in the hand, apply the salt, the best you can get. For a slow curing cheese, use three pounds to the curd from 1,000 pounds of milk, and for cheese to ripen faster, use two and one-half pounds, putting on carefully so as to have it evenly distributed. After the salt has been well stirred in and had time to dissolve, say about fifteen minutes, it is ready for the press.

It is not necessary to keep the "making" room shut up close, as many makers do, except from the time the rennet is put in the milk until the curd is cut in the vats. The cheese will be all the better if there has been a free circulation of pure fresh air in the room during the whole process. Of course the curd should be covered with a nice, clean cloth when not being stirred or turned.

All cheese in a section, state or province (except those made for a special market) should not only be uniform in make but in size and finish as well. Therefore it would be well to weigh the curd into the hoops so as to have the cheese all the same size. If the curd has been handled carefully and has carried the correct amount of moisture, the cheese will take a nice finish if put to press at eighty-four degrees. It will not look so much like fat or be so liable to puff as if put to press at a higher temperature. Press gradually at first, getting stronger and stronger, and in about forty-five minutes take the cheese out, pull up the bandage so as to leave no wrinkles, and have the same perfectly straight. Put on the capcloths nicely, then put back in the press, and apply the pressure, adding to it several times during the evening, but not too strongly. All cheese should be turned in the press in the morning and left under pressure until about the time the press will be needed in the afternoon.

CURING.

It is very important to have an even temperature of about 70 degrees for curing cheese. In summer, the doors and windows of the curing room should be opened in the evening after sundown, and early in the morning, and closed shortly after sunrise to keep out the heat. An ice-box which can be easily lowered to put in the ice, and raised to near the ceiling, is a very good thing to have in excessively hot weather. If the day is cool, it is well to leave the shutters and windows open on the shady side of the building. Cheeses will be all the better for getting plenty of light and air, but they must be kept out of direct draughts, and the sun should not be allowed to strike them. When the weather is cool in spring and fall, provision should be made to keep the temperature up to about 70 de-

grees. By heating with steam from the boiler, the risk from fire will be less, and a more even temperature can be had at less cost than with a stove.

The whole curing room should be clean, and in order, but the shelves need to be dusted every day when new cheese is put on them. Stencil the day of month, and number of vat on the cheese when they are put on the shelves, then if you want something nice for exhibition purposes, you will have no difficulty getting those belonging to the same batch as the one you try, or if a lot develops an undesirable flavor, you know where they are without trying every cheese. Trying cheese injures them somewhat, and they should be tried only for information, not to satisfy curiosity.

SHIPPING.

Turn every day until three or four weeks old, when they will be fit to ship. When boxing cheese, stencil the weight on the right hand side of the seam, resting the stencil on the lower band of the box, and having the weight as near the seam as possible. To distinguish each month's make when boxed, place directly over the weight the figure "1" for May, "2" for June, "3" for July and so on. Put brands on neatly and distinctly, and do not blacken the box. When boxing put two scaleboards on each end of each cheese.

Weigh carefully. Remember it is always better to have the number of pounds in the box to correspond with what is marked on the outside of it. Put covers on the boxes so the double wood of the cover will be directly opposite the seam in the box, then there will be sufficient wood to hold the nails, and they will not injure the cheese. Always nail the covers unless instructed by the buyer not to do so. Of course it is understood that the cheese has been inspected by the purchaser before being boxed. It always pays to have good boxes, even if they do cost a cent or two more than poor ones.

Allow no cheese to be drawn to the shipping place in a dirty wagon. Get men to load them on end rather than on the side. When shipping by rail see that the cars are clean. Get the railway or steamship agent to count, and give you a receipt for the number of boxes shipped. Accept no receipt marked "shipper's count." When shipping cheese, send an invoice to the consignee, and send separate invoices for different months make. "White" and "colored" cheese also require to be invoiced separately, even if made in the same month. When you have won the confidence of the buyer and he does not give your cheese as close an inspection as he otherwise would do, if you have any cheese that are not strictly fine, put a distinguish-

ing mark on them and invoice them separately. By attending to all such details you will get the good will of the buyers, they will be more anxious to deal with you, and you are sure to get better prices.

You will understand by this time that cheese-making is no lazy man's job, and that most of the maker's time is required at the factory. While airing the curing room in the evening he will have some time for reading and study, of which he should take advantage. Cheese-makers and dairymen generally, should be readers so as to profit by the experience of others. There is not so much originality in the world as some of us are apt to think. Take the origin of co-operative dairying for instance. If Mr. Smith's son had remained at home with his father and not got married, the chances are that Mr. Smith would not have the honor of being the first to operate a co-operative cheese factory. There are plenty of excellent dairy papers available and in order to keep up with the times, one must read. As I said before, profit by the experience of others.

> "Who heeds not experience, trust him not, tell him
> The scope of one mind can but trifles achieve.
> The weakest who draws from the mine will excell him,
> The wealth of mankind is the wisdom they leave."

In conclusion I want to say to those who have the employing of cheese and butter-makers, that they must not only consider what they pay, but the amount they will lose if they have not a good careful manager. I have in mind now two creameries that were operated quite close together one winter, the milk delivered at each testing practically the same. Both factories used the same kind of separators, churns, etc., yet one paid his patrons nearly 8½ cents net per 100 pounds of milk more than the other, or upwards of $100 per month; and, mark you, both butter-makers ranked as first-class men. At a certain cheese factory in our neighborhood, during the season of 1897 the maker took 10.90 pounds of milk to each pound of cheese, while another man in the same factory made a better quality of cheese from 10.37 pounds of milk during 1898. The factory was a large one, making about 140 tons. The saving in this way to the producers amounted to considerably more than the better man got for manufacturing.

BANQUET.

THE FIRST ANNUAL BANQUET OF THE VERMONT DAIRYMEN'S, VERMONT BUTTER AND CHEESE-MAKER'S AND VERMONT MAPLE SUGAR MAKER'S ASSOCIATIONS WAS HELD IN KNIGHTS OF PYTHIAS HALL, ST. JOHNSBURY, VT., WEDNESDAY EVENING, JANUARY 4, 1899.

Three hundred ladies and gentlemen sat down to tables well ladened with the necessaries of life, provided by S. D. Atwood, caterer, St. Johnsbury.

Mr. Atwood has received many compliments for his management of the affair and the thanks of all are likewise due to the waiters for the very excellent service rendered, to the orchestra for the fine music, and to Mr. Scarff of Burlington, who added much to the pleasure of the evening by giving several of his original dialect recitations.

Divine blessing was asked by Rev. Thomas Tyrie of St. Johnsbury. President Smith then told one of his good Methodist stories, which had, as usual, a very taking effect, and introduced Hon. C. J. Bell of East Hardwick as toastmaster, which position he most acceptably filled.

Gov. Smith and Lieutenant-Governor Bates were present, as well as many other prominent men of our own State and from Massachusetts, New Hampshire and Canada.

PROGRAMME.

TOASTS AND RESPONSES.

1. Invocation ..... REV. THOMAS TYRIE
2. Vermont Quickstep ..... ORCHESTRA
3. Vermont's Future ..... GOV. E. C. SMITH
4. Adulterations ..... PROF. J. L. HILLS
5. Intensive Farming ..... DR. J. B. LINDSEY
6. Dairying in New Zealand ..... HON. H. C. IDE
7. Farmers' Boys and Agricultural Colleges ..... PROF. S. C. KEITH
8. Vermont's Best Product—Her Sons and Daughters, ... MRS. R. B. GALUSHA
9. The Women of Vermont ..... JOHN E. GALE
10. Farm Homes and the Church ..... REV. THOMAS TYRIE
11. A Square Meal (for the dairy cow) ..... HON. C. H. WATERHOUSE
12. Our Patrons ..... J. J. JACKSON
13. Our Markets ..... J. HARVEY WHITE
14. Dairying in Canada ..... HON. THOMAS J. DILLON
15. Vermont Sweets ..... HON. A. J. CROFT
16. Our Educational Needs ..... SUPT. M. S. STONE
17. Good Night ..... ORCHESTRA

REPORT OF BUTTER AND CHEESE.

BUTTER EXHIBIT.

Whole number of entries	127
Highest score	97½
Lowest score	86
Average score	93

Premiums awarded as follows:

CLASS 1. DAIRY TUBS.

		Prize.	Score.
1st.	J. C. Sherburne, N. Pomfret	$10 00	96½
2nd.	J. M. Campbell, Morristown	6 00	96
3rd.	Charles LePage, Barre	4 00	95½

CLASS 2. DAIRY BOX.

1st.	J. H. Loveland, Norwich	10 00	95½
2nd.	D. W. Roberts, N. Pomfret	6 00	95¼
3rd.	Stephen Hewett, N. Pomfret	4 00	95

CLASS 3. DAIRY PRINTS.

1st.	J. B. Candon, Chittenden	10 00	97
2nd.	Charles A. Choate, W. Barnet	6 00	96½
3rd.	Noah S. Walker, Clarendon	4 00	96

CLASS 4. CREAMERY TUBS.

1st.	G. M. Hayward, E. Corinth	10 00	97½
2nd.	T. E. Donahue, Hinesburgh	6 00	97
3rd.	George A. Doe, Corinth	4 00	96¾

CLASS 5. CREAMERY PRINTS.

1st.	F. L. Smith, Fletcher	10 00	96
2nd.	C. B. Vincent, Glover	6 00	95½
3rd.	Farmers Mutual Creamery, St. Johnsbury	4 00	95

VT. DAIRYMEN'S ASSOCIATION GOLD MEDAL.

G. M. Hayward, E. Corinth 97½

VT. BUTTER AND CHEESE MAKERS' ASSOCIATION CUP.

G. M. Hayward, E. Corinth..... 97½

CREAMERY SWEEPSTAKES.

G. M. Hayward, E. Corinth..... ... $5 00 97½

DAIRY SWEEPSTAKES.

J. B. Candon, Chittenden..... 5 00 97

GRAND SWEEPSTAKES.

G. M. Hayward, E. Corinth..... 10 00 97½

BEST DISPLAYED PACKAGE.

Mrs. Martha Mason, Passumpsic..... .....$3 00

WORCESTER SALT PRIZES.

CREAMERY BUTTER.

1st. G. M. Hayward, E. Corinth, $25.00 Gold Watch
2nd. T. E. Donahue, Hinesburgh, $15.00 Gold Watch.

DAIRY BUTTER.

1st. J. B. Candon, Chittenden, gold watch valued at..... .....$25 00
2nd. J. C. Sherburne, North Pomfret, gold watch valued at..... 15 00

Worcester Salt Co. cash prize of $25.00 in gold to the winner of sweepstakes and association gold medal, G. M. Hayward, E. Corinth.

VT. FARM MACHINE CO. PRIZES.

BUTTER FROM COOLEY CREAMER.

1st.	S. H. Warren, North Pomfret.....	15 00	95
2nd.	D. S. Willard, North Hartland	10 00	94
	Brattleboro Creamery, Brattleboro		94
3rd.	Rollin W. Whitney, Springfield....	5 00	93
	F. L. Davis, North Pomfret.....		93
	Valley Creamery Asso., Westminster		93

For butter scoring highest made from United States Separator :

1st.	Geo. A. Doe, Corinth	15 00	96¾
2nd.	Noah H. Walker, Clarendon	3 33	96
	E. E. Symes, Topsham	3 33	96
	F. L. Smith, Fletcher	3 33	96
3rd.	Randolph Creamery, Randolph	2 50	95½
	C. B. Vincent, Glover	2 50	95½

Orin Douglass Butter Culture Prize:

2nd. T. E. Donahue, Hinesburg 5 00

Two gallons Wells, Richardson & Co.'s Butter Color ; highest score in creamery butter; G. M. Hayward, E. Corinth.

One gallon Wells, Richardson & Co.'s Butter Color; highest score in dairy butter; J. B. Candon, Chittenden.

CULTIVATOR AND COUNTRY GENTLEMAN PRIZES.

To butter scoring highest, one copy, G. M. Hayward, E. Corinth.

To cheese scoring highest, one copy each to

J. C. Oliver, W. Charleston,	95
P. M. McDonough, Hinesburgh.	95

FARMERS' ADVOCATE PRIZE.

To best dairy butter, one copy, J. B. Candon, Chittenden.

To best creamery butter, one copy, G. M. Hayward, E. Corinth.

To cheese scoring highest, one copy each to

J. C. Oliver, West Charleston,

P. M. McDonough, Hinesburgh.

MIRROR AND FARMER PRIZE, TO EACH PRIZE WINNER.

Chas. LePage	Barre
J. M. Campbell	Morristown
J. C. Sherburne	N. Pomfret
J. H. Loveland	Norwich
D. W. Roberts	N. Pomfret
Stephen Hewitt	N. Pomfret
Noah S. Walker	Clarendon
J. B. Candon	Chittenden
Chas. A. Choate	W. Barnet
Geo. A. Doe	Corinth
G. M. Hayward	E. Corinth
T. E. Donahue	Hinesburgh
Farmers Mutual Creamery Association	St. Johnsbury
C. B. Vincent	Glover
F. L. Smith	Fletcher
J. P. Oliver	W. Charleston

Alpha Messer.....Rochester
C. H. Weed.....Essex
P. M. McDonough.....Hinesburgh
Geo. Johnson.....Chippenhook
Ed. Bissonett.....Addison
T. B. Harriett.....N. Georgia

PRO RATA CLASS.

All those scoring above ninety not taking any prizes.

	Score.
P. P. B. Northrup, Sheldon	92
C. F. Smith, Morrisville	94
T. H. Lyster, St. Johnsbury	90
W. J. Henderson, Lower Waterford	91
Harvey Burbank, St. Johnsbury	93
Mrs. Thomas Mason, Passumpsic	92
G. R. Maxham, Bridgewater	93
Stephen Hoar, Barnard	94
S. H. Warren, N. Pomfret	95
E. & T. Fairbanks, St. Johnsbury	91
M. D. King, Woodstock	93½
W. W. Sprague, E. Brookfield	90
G. H. Soule, Fairfield	93
H. W. Walker, S. Woodstock	90
P. W. Strong, N. Pomfret	92½
O. M. Tinkham, N. Pomfret	92
W. R. Connal, Newport Center	93
D. A. Kneeland, Waitsfield	93
H. S. Eldred, Sheldon	93½
C. F. Rutney, Coventry	91
J. B. Dimon, Highgate	93½
Cloud Harvey, W. Barnet	93½
G. H. Terrill, Morrisville	92½
S. S. Pike, Marshfield	92
Chas. Weeks, St. Johnsbury	91
Eugene Town, Milton	94
Nelson A. Park, S. Ryegate	93½
O. G. Carpenter, Cambridge	91
O. T. Ware, Brattleboro	92
Rollin Whitney, Springfield	93
H. B. Leonard, North Pomfret	90
F. L. Davis, North Pomfret	93
E. C. Rowe & Son, East Albany	92
C. D. Smead, West Brookfield	93
J. F. Adams, East Barnet	92

D. C. Howard, East Haven	94
N. Bigelow, Stowe	93
R. M. Lawrence, West Waterford	91
J. R. Miller, Ryegate	92
Mrs. C. J. Nelson, Ryegate	93
Mrs. Martha Mason, Passumpsic	94
Nathan H. Ricker, Ryegate	94½
J. A. Hunter, East Burke	95
P. R. Gale, Stowe	93
P. D. Ballard, Cambridge	93
E. O. Cushman, St. Johnsbury, East	90
B. R. Smith, Passumpsic	95
E. L. Paine, Pittsford	93½
George Davis, East Montpelier	92
F. N. Coveney, Danville	94½
J. R. Whitcher, South Ryegate	93
D. S. Willard, North Hartland	94
Geo. C. Bean, Coventry	95
Chas. R. Spafford, Chippenhook	92
F. G. Stonebridge, West Barnet	91
C. E. Whitehill, Barnet	94½
F. L. Kibbee, Fairlee	95
Sharon Creamery, Sharon	94
Brattleboro Creamery Association, Brattleboro	94
B. A. Holt, South Ryegate	95
A. N. Day, Sheffield	92½
T. M. Casey, Huntington Center	94½
W. V. Beach, Charlotte	95½
C. B. Vincent, Glover	95½
E. E. Symes, Topsham	96
G. A. Kelley, Marshfield	94½
Geo. H. Symmes, North Ryegate	94
G. H. Albee, Westford	92
W. H. Stearns, East Johnson	95½
H. D. Chamberlin, Wells River	94½
E. C. Hillis, North Montpelier	95
J. J. Jackson, East Montpelier	93
O. B. Landon, Johnson	92
S. L. Tupper, Bakersfield	91
E. R. Towne, Waterbury	93
East Ryegate Creamery, East Ryegate	91
G. E. Campbell, Newport Center	95
G. H. Temple, Randolph Center	91
South Peacham Creamery Ass'n, South Peacham	95½
J. G. Turnbull, Barton Landing	94
Randolph Creamery, Randolph	95½
W. G. Simpson, Washington	94

C. C. Lawless, North Montpelier	94
G. I. Wilcox, Woodstock	95½
D. G. Donahue, Charlotte	93
M. F. Donahue, Ferrisburgh	96
E. A. Gibson, Derby	94
Lunenburgh Creamery, Lunenburgh	91
H. A. Churchill, Cambridge	93
N. L. Parker, E. Burke	91
E. C. Pierce, N. Clarendon	90
H. L. Lyster, Ryegate	92
Valley Creamery, Westminster	93
Woodstock Creamery, Woodstock	94

CHEESE EXHIBIT.

Whole number of entries	15
Highest score	95
Lowest "	85
Average "	91¼

Premiums awarded as follows:

CLASS A. DAIRY PLAIN.

		Prize.	Score.
1st.	J. C. Oliver, W. Charleston	$10 00	91
2d.	Alpha Messer, Rochester	6 00	85

CLASS B. DAIRY SAGE.

1st.	J. C. Oliver, W. Charleston	$10 00	95
2d.	Alpha Messer, Rochester	6 00	85

CLASS C. FACTORY PLAIN.

1st.	P. M. McDonough, Hinesburgh	$10 00	95
2d.	C. H. Weed, Essex	6 00	94½
3d.	Geo. Johnson, Chippenhook	4 00	93

CLASS D. FACTORY SAGE.

1st.	T. B. Harriett, N. Georgia	$10 00	92
2d.	P. M. McDonough, Hinesburgh	6 00	91
3d.	Ed. Bissonett, Addison	4 00	90

CHEESE SWEEPSTAKES.

J. C. Oliver, W. Charleston	$ 2 50	95
P. M. McDonough, Hinesburgh	2 50	95

REPORT OF COMMITTEE ON RESOLUTIONS.

Read by V. I. Spear.

Resolved, That the Vermont Dairymen's Association desires to recognize the many favors and courtesies extended to it which have contributed to the success of this its twenty-ninth annual meeting and does hereby extend its thanks:

To the people of St. Johnsbury and the local committee of its citizens for the aid furnished in supplying music and halls for meetings and exhibits.

To the hotels of St. Johnsbury for concessions granted.

To the railroads of the State for reduced rates of fare over their lines.

Resolved, That we ask our delegation in Congress to use all their influence to secure the passage of a pure food law, whereby honest production shall be relieved of unjust competition with the various forms of adulterations now met with in our markets.

REPORT OF SECRETARY AND TREASURER OF VERMONT DAIRYMEN'S ASSOCIATION.

From December 1, 1897, to December 1, 1898.

Received State appropriation	$1,000 00
Received memberships	79 00
Received for advertising	156 00
Total	$1,235 00

BILLS PAID AS PER ORDERS.

E. L. Hildreth & Co.,	$ 29 97
W. H. Jordan	39 52
H. W. Walker	5 45
C. F. Smith	20 43
Eugene Girard	39 00
G. W. Pierce	199 59
J. J. Thompson	5 50
G. E. Stratton	15 00
Orin Douglas	37 40
G. H. Claflin	4 28
E. B. Voorhees	64 60
Mrs. A. C. Ware	14 46
St. Albans Messenger Co.	59 41
J. J. Thompson	1 00

H. E. Cook	29 58
Mrs. C. D. Whitman	3 00
F. C. Williams	1 00
Free Press Association	49 48
E. L. Hildreth & Co.	3 00
Lamoille Publishing Co.	4 50
G. E. Stratton	26 98
E. L. Hildreth & Co.	4 50
E. L. Hildreth & Co.	13 50
J. L. Hills	7 91
G. W. Pierce	154 70
Orrin Bent	38 64
Paid last year's deficit and interest on borrowed money	45 59
Paid other bills as per vote of the Association	256 55
Total expenditures	$1,174 54
Balance in treasury	$60 46

HOMER W. VAIL, Treas.
G. W. PIERCE, Sec.

REPORT OF LEGISLATIVE COMMITTEE.

BY V. I. SPEAR, CHAIRMAN.

Mr. Spear:—Your Committee would respectfully report the result of their work upon the two subjects referred to them by your body. The first subject was the inspection of cattle foods brought into the state. We refer you to the law passed relating to this subject which gives all that was asked for in that direction. The law provides for the inspection of all concentrated cattle foods brought into the state. The pure grains are not required to be inspected. The next subject considered by your Committee was in regard to some measure looking towards the regulation of the operation of creameries. A call was issued to creamery men and prominent dairymen to meet your Committee at Montpelier and give their views on various propositions submitted to them. A good number attended this meeting and after full discussion your Committee introduced the bill providing for the inspection of creamery apparatus and licensing operators of the Babcock test which bill has become a law. Your Committee is in no way to be credited with nor is it responsible for the law passed requiring creameries to make a certain form of statement to their patrons.

Report adopted.

Mr. Spear:—Mr. President:—There is another matter I would like to bring before this meeting. I think it should receive the attention of every farmer and dairyman. During the past year, parties known as "creamery promoters" have been operating in several towns in Vermont. These people represent some creamery supply house located outside the state, usually some wholesale dealer. Their mode of operating is to go among the farmers in some town and get them to sign a contract for a certain amount of stock in a creamery plant to be built there. The price called for in the contract for the creamery plant is usually about twice what it would cost to build and equip it. The machinery furnished is often of poor quality. They are frauds and dairymen should let them alone. They have operated extensively in other states to the great injury of the dairy industry. Just before coming here I received a letter from a former president of this association, Mr. Sanford, stating that his town had recently been visited by these people and asking me to bring the matter before this meeting. In view of these facts I have prepared the following statement which I submit to you for such action as you think best:

It has come to the knowledge of the Vermont Dairymen's Association that, in various sections of Vermont, parties known as "creamery promoters" have been contracting with farmers for expensive creamery plants, in which the contract price agreed upon has been far in excess of the requirements of the business; and that in some sections such plants have been contracted for where there is not sufficient milk produced to pay the expense of operating a creamery. We hereby desire to call the attention of the farmers of Vermont to the fact that creamery promoters have operated in other states in a manner similar to the plan introduced into this state ; and that this work has resulted to the great injury of the dairy interests and to a large financial loss to stockholders in such organizations. We would therefore caution and warn the dairymen of Vermont in relation to this matter and call attention to the fact that wherever a creamery is needed we have plenty of responsible dairy supply houses in this and other states ; and that the quality of supplies furnished and prices charged for the same by these houses entitle them to the confidence and patronage of the dairymen. We earnestly advise that contracts for creamery plants be not placed with unknown persons.

President Smith. We have heard the remarks and suggestions of Mr. Spear. What action do you wish to take ? Do you present the statement as a resolution ?

Answer—Yes.

Resolution adopted.

Question—Would not it be well to have the secretary see that these resolutions are printed in the papers of the State?

President Smith. I would suggest that the secretary see that is done.

Member. I would suggest having it posted in the post offices.

President Smith. I would say that about two months ago one of these smooth-tongued fellows came and called at my place, and bothered me until I could shake him off. Are there other matters of business? If there is none, the hour has arrived for the annual election of officers, and I would take this opportunity to thank the members for their support. I have enjoyed the work very much and have endeavored to act as far as capable for the best interests of the Association.

ELECTION OF OFFICERS.

Election of officers resulted in the choice of Geo. W. Pierce of Brattleboro for president, M. W. Clark of Richmond and J. J. Jackson of East Montpelier for vice-presidents, F. L. Davis of North Pomfret for secretary, P. W. Strong of North Pomfret for treasurer, and Geo. Aitken of Woodstock for auditor; following which adjournment *sine die* took place.

WOMAN'S AUXILIARY.

The Woman's Auxiliary of the Vermont Dairymen's Association held its annual meeting in the parlor of the Avenue Hotel at 9.30 A. M. Wednesday, January 4.

Meeting opened by singing, followed by prayer by Mrs. Fannie A. Drew of St. Johnsbury. Report of secretary read, accepted and adopted.

PRESIDENT'S ADDRESS.

Mrs. Mary A. Smith, Morrisville.

Another year of life with us as an auxiliary to the Vermont Dairymen's Association has moved on into the past. We are allowed to come from our various walks and works in life, and we can each bring a crumb, at least, of experience, knowledge and good cheer that will be helpful, so that those who are permitted to journey yet a little while longer may have the pleasant memories of this meeting to come as rays of sunshine to rest and comfort when weary with the toil and care of home and family or perchance when shut in with suffering. How much beyond price are the kindly sympathetic greetings from memory's page? Our name indicates that we help or assist the main branch. Perhaps a retrospective glance may enable us to make this auxiliary more practically helpful not only to the members of the Vermont Dairymen's Association but to the women of our State. The arguments are yet fresh in mind which Hon. H. M. Arms and others presented five years ago, urging the desirability of an organization of the women who are interested not only in the dairy industries of our State but in *all* that bring to the farmers' home an uplift. It was suggested that as the dairy product was being taken from the farm for manufacture more each succeeding year, our women would not care so much for the papers and discussions at the dairymen's meetings, hence would not accompany the good man when he took this annual outing; while if part of the time could be used by them in discussing some of the questions that are daily, yes, *hourly* coming to the intelligent, thinking home-maker they would be more glad of the rest and recreation obtainable. As co-workers we are interested in all that interests them, but we believe that President Arms realized that the dairymen's meeting to be a success must have the women in

attendance, hence worked to devise means that should bring them out to these gatherings. Possibly the auxiliary membership is not as large as it would have been had its objects, as well as the circumstances under which it came into life, been more fully and generally understood by our women.

The Woman's Auxiliary was organized because the Dairymen's Association thought it would be a benefit to all. Perhaps the lack of missionary work by our members among their stay-at-home neighbors and friends has lessened materially the interest in these meetings which was hoped for. However, in some ways it has been a success. It has been an established fact that the dairyman and farmer can more successfully carry on his business after this little vacation and opportunity for exchange of thought. If this is a profitable season for the farmer will it not be for the farmer's wife? The world is a book and the woman who never leaves home seldom reads more than one page of it. It is an association that stimulates thought and broadens the vision. It can not be said that women as a class are less womanly because they have in the last quarter of this wonderful century been taking a wider outlook and been more active on a "ways and means committee" for home interests than formerly. "It is not all of life to live." If we would meet the approval of our own conscience and by and by hear the "well done" which we wish to, we must not only live, but live well our allotted time. New England women, Vermont women must be in the front ranks of the onward march. It has been said that a nation can never rise above its motherhood. Is it possible for State or town to do so? Do we often find a home where the moral and spiritual atmosphere is on a higher plane than that which is daily diffused by the mother.

Vermont was the first State to have a dairymen's association and Vermont dairymen were the first to ask for an auxiliary, and I believe there is work for us as an auxiliary to do.

The thought which our secretary expressed last evening, relative to the teaching of a course in domestic science in our schools is a good one, and to bring such a course into the school curriculum of our State is an object worthy our best effort. We women should also work to create public sentiment against licensed saloons, for our legislature meets again in two years. I wish we might have more aggressive work against cigarette smoking. Much is said and written these days about educating the boys and girls and this is well, but we women, especially those of us who live on the farms should try to keep in touch with the spirit of progress. This has been a century of development and evolution. Fifty years ago causes and effects of every day occurence were as mysterious and unknown as the Greek alphabet. Hygiene, sanitation, microbes, parasites and germs were then considered even by the M. D. as having very little practical relation to life.

Ignorance can not be bliss when we consider that in our war with Spain more of our boys were killed by germs than by bullets.

The annual meetings of the Woman's Auxiliary to the Vermont Dairymen's Association should be a means of gaining knowledge and arousing more interest in home-making, and *all that pertains* thereto. May we each set our standard of home-making high and never weary until we have done all we can for God and home and all mankind.

DOMESTIC AFFAIRS.

Mrs. Helen Higgins of St. Johnsbury read a paper upon domestic affairs.

In speaking of the average housekeeper's many and varied duties she referred to the need of her knowing how to do a greater number of things *well* than any other class of workers, using judgment and energy. It requires a great deal of knowledge to make, mend, wash, bake, clean, also to be preacher, teacher, doctor, etc., using tact and patience to go on with her numberless tasks. In referring to the care of the dairy utensils, she said use a five cent vegetatable brush outside and in to remove everything from seam or rim before pouring in boiling hot water. Use a brush for cleaning vegetables. She spoke of the need of a thorough knowledge of food suitable for this climate,and how to secure a variety from the winter's supply of meat. Make a pie similar to a chicken pie from beef and pork seasoned well and plenty of gravy. Then make a "mock oyster soup," cut part of a hard head of white cabbage into pieces smaller than an oyster, boil in water enough to cover till done, add milk or cream, thicken slightly and season to taste, use with croutons, hot crackers, or toast for supper on a cold night when the children come from school.

Hot milk taken before or after a cold ride warms, stimulates, nourishes and helps to resist cold.

She said lack of skill was a waste of time, so learn to be skillful in doing everything that comes to you. She urged the mid-day rest, a nap if possible, to freshen one for the remaining duties, that we may feel glad all our days till we are eighty or ninety. Ruskin says: "God gave us strength enough and sense enough for everything He wants us to do."

Give the children the best of your time and thought; give if possible an undisturbed hour daily to them. Make the most of your opportunities and determine to achieve success wherever you are.

Mrs. Anna Spencer Frost of St. Johnsbury gave two excellent readings in a delightful manner which won the praise of the audience.

The St. Johnsbury orchestra furnished music for the evening.

CLASSIFICATION AND COMBINATION OF FOODS.

MISS ANNA BARROWS.

The subject of the classification and combination of foods is a large one and hardly can be covered in a single evening. There are many ways in which foods are classified, but for practical uses we may group them under five heads. These are :— water and mineral substance (which are more or less present in all foods,) carbohydrates, (including starches and sugars,) proteids and fats.

To-day more attention is given to the food of the cow than to the food of men and women, but gradually more thought is being put upon the choice and preparation of human food. To-night I will prepare what we may call typical foods.

ENTIRE WHEAT BREAD.

In making bread to-night I am going to use the entire or whole wheat flour. Milk is used for mixing because it adds to the nutritive value of the product. Skimmed milk would answer for this purpose. The addition of salt and sweetening is largely a matter of taste. When shortening is used it is put in the hot liquid with the sugar and salt and the yeast is added when the mixture has cooled to 100° F. or less so there will be no danger of cooking the yeast. One cup full of liquid and three cupfuls of flour is a good proportion for a small loaf of bread. The quantity of yeast must be very much increased when the time for rising is as short as it must be this evening. With entire wheat flour a little less is usually required to make a dough of the same stiffness as ordinary bread flour. With pastry flour it is often necessary to use four times as much flour as liquid. The dough is kneaded just enough to leave it smooth and in good condition for rising. Now we cover it over and put it in the pan and set the pan in another of warm water that the dough may rise rapidly.

We do not begin to make the use we might of fruits as foods ; we are inclined to look upon them merely as relishes.

There are many times when we might substitute apples for potatoes to serve with fat meats during the winter months. To-night I shall use a tin can of fruit such as may be found everywhere.

Though the process of canning is a simple one it seems to be a mistake for the average housekeeper to endeavor to can such a large amount each season. If there could be a co-operative canning factory in every community the work could be done more easily and more surely, for in the factory the cans may be subjected to a higher degree of heat than is possible over the ordinary cook stove. The spoiling of canned fruits is due to the action of bacteria. If everything that comes in contact with the fruit is thoroughly sterilized or subjected to proper heat then we may be reasonably sure that the fruit will keep. Perfect cleanliness is essential. Apples may be satisfactorily combined with other fruits of more pronounced flavors. The dried or evaporated fruits are often better than the cheaper grade of canned fruits. We might use dried apricots to-night instead of these from the can. To prepare them they should be washed after soaking for half an hour, and the water thrown away, then cover with cold water and soak for twenty-four hours if possible and then cook slowly for about a half hour. Plenty of water and sufficient time for soaking is more desirable than a longer period of cooking.

QUICK FRUIT DUMPLINGS.

The contents of the can are put in a stew pan to heat. Meantime a dough is mixed from one cupful of flour with which two level teaspoonfuls of baking powder and one quarter of a teaspoonful of salt has been sifted. About one-half cupful of milk is required to make this into a soft dough which is then dropped from a teaspoon on top of the hot fruit. The stew pan is covered closely and the dumplings are allowed to cook for ten minutes. They are then removed, the fruit sweetened and served with them as a sauce. Whipped cream or butter can be eaten with them if desired. A very small amount of shortening might be rubbed into the flour, but the dumplings will not be as light and it is better to eat cream or butter with them afterward.

This illustrates how we are constantly combining our foods to bring all the five food substances into a single dish. Here the fruit gives water, the flour furnishes starch, the milk supplies a little nitrogenous matter, as does the flour also, and the cream or butter eaten with the pudding supplies fat. A beef stew illustrates another combination where the meat supplies the proteid or nitrogenous matter and fat, and the vegetables give the starch and sugary substances, all more or less blended with water.

Baked beans, fish balls, hashes and salads are all illustrations of combinations of food materials tending toward a balanced ration. But we have not yet tried experiments enough on human beings to know just what is the best ration for work of different kinds.

I have here half a pound of cheese, the average price of which is sixteen cents per pound. Here we are getting much more for our money than from meat at the same price, for while beef is two-thirds water, cheese is only about one-third water, and the kind of nutriment is similar in both, mainly fat and nitrogenous matter. One objection to cheese is that it is not easily digested, and this is mainly because it is so concentrated. Therefore it is often better to dilute it with milk and combine with eggs and toast something after the fashion of Welsh rarebit. Such dishes from cheese may be occasionally substituted for meat and be very satisfactory in family life. The seasoning should not be too high; that is the fault of many dishes made from cheese.

In answer to the question how to make beef tea for invalids; there are several ways. One is to broil a piece of juicy beef slightly, just enough to warm it through, then cut into small pieces and press through a strainer of some kind. Another way is to scrape the meat fine, cover with water and leave for an hour or more. Then strain off the water, heat slightly, season and serve at once.

At the close of her address Miss Barrows invited any in the audience who wished to come forward to the platform and sample the food she had prepared. The invitation was accepted by about one-third of the large audience and the dishes pronounced delicious, especially her fruit dumplings.

These illustrated cooking lectures afford so much useful information on the preparation of nutritious and healthful foods that all ladies should make an effort to attend them.

Miss Barrows was asked as to methods used in other States to introduce the study of domestic science in schools. She replied that it was usually started by some woman's club or organization and then taken up by higher institution of learnings.

A committee was appointed to revise the constitution of the Auxiliary, consisting of Mrs. R. B. Galusha, Jericho ; Mrs. E. T. Carpenter, Waterbury, and Mrs. S. A. Vail, North Pomfret.

It was voted to ask the Vermont Dairymen's Asiociation to change the date of its annual meeting that it may not come on the week of prayer.

Officers elected for the coming year : President, Mrs. Mary A. Smith, Morrisville ; Vice-President, Mrs. S. A. Vail, North Pomfret ; Secretary, Mrs. Alvira A. C. Ware, Brattleboro.

LIST OF MEMBERS OF WOMAN'S AUXILIARY.

Mrs. Margaret M. Reed.....Burlington
" May H. Pitkin.....Marshfield
" Carrie A. Nelson.....Ryegate
" Annie Dodge.....Morrisville
" Mary A. Smith.....Morrisville
" D. D. Howe.....Burlington
" Mary R. Ralph.....Brookfield
" A. L. Walker.....So. Woodstock
" Elinor T. Clark.....Brookfield
" E. P. Carpenter.....Waterford
" S. J. Hastings.....Passumpsic
" F. S. Collins.....Burlington
" George Crane.....Wilmington
" C. J. Bell.....Hardwick
" Luna S. Peck.....Brookfield
" Maria Peck.....Hinesburgh
" L. R. Jones.....Burlington
" C. M. Winslow.....Brandon
" J. O. Sanford.....Stamford
" Mary Kibbe.....Brookfield
" Louis W. Clark.....Brookfield
" A. B. Manchester.....Randolph
" T. F. Betterley.....W. Brattleboro
" C. H. James.....Cornwall
" I. T. Story.....Essex
" Alvira A. C. Ware.....Brattleboro
" Sarah J. R. Whitman.....Brattleboro
" Hazen.....Hartford
" Jennie Bronson.....E. Hardwick
" Ida M. Pierce.....Brattleboro

1897.

" Jennie L. Brock.....Barnet
" F. L. Smith.....Fletcher
" M. W. Clark.....Williston
" John Smith.....Newbury

1898.

" Jennie S. Bentley.....St. Albans
" M. A. Curtis.....Georgia
" M. B. Fuller.....Georgia
" C. E. Martin.....Rochester
" E. W. Smith.....E. Berkshire
" E. R. Towne.....Waterbury
" R. B. Galusha.....Jericho

Mrs. H. M. Crane.....St. Albans
" O. T. Sunderland.....Georgia
" M. L. Aseltine.....N. Fairfax
Miss Elma Eldred.....Sheldon
Mrs. E. M. Denny.....Montpelier

NAMES OF NEW MEMBERS.

Mrs. Fannie A. Drew.....St. Johnsbury
" C. H. Higgins.....St. Johnsbury
" Alma F. Waters.....St. Johnsbury
" Mary A. Brackett.....St. Johnsbury
" Genevieve Snow Davis.....No. Pomfret
" Bessie H. Strong.....No. Pomfret
" S. A. Vail.....No. Pomfret
" I. C. Houghton.....Lyndon
" L. F. Bickford.....Bradford
" L. H. Davis.....Bradford
" J. E. Bass.....Randolph

ALVIRA A. C. WARE, Secretary,
Brattleboro.

STATEMENT OF METHODS EMPLOYED BY WINNERS OF BUTTER PRIZES.—CLASS 1. DAIRY TUBS.

No.		FIRST PREMIUM. J. C. SHERBURNE, N. Pomfret.	SECOND PREMIUM. I. M. CAMPBELL, Morristown.	THIRD PREMIUM. CHAS LE PAGE, Barre.
1	What number and breed of cows from which this butter was made?	18 Jerseys.	5 Grade Jersey and Guernsey.	18 Grade Jerseys.
2	How much and what kinds of feed per cow?	4 pounds corn meal, 3 pounds of bran; nice hay.	Oat hay and corn stover twice a day, rowen once; grain, corn and barley and 3 parts meal and bran to 1 part cotton-seed.	Clover hay, 3 pounds bran, 2 pounds corn meal.
3	What is the cost of this ration per day per cow?	15 cents.	15 cents.	Grain cost 4 cts per day.
4	By what process or apparatus was the cream obtained?	DeLaval Separator.	De Laval Separator.	De Laval Separator.
5	How long was the cream kept, and in what condition when put in the churn?	1 to 4 days; sour.	1 week; slightly acid.	3 days; held 24 hours to ripen.
6	At what temperature was the cream? Kind of churn used?	60°. Square box.	62°. Franklin Co. Barrel.	61°. Davis Swing.
7	What length of time churning?	One hour.	40 minutes.	35 minutes.
8	Do you wash and salt while in granular form?	Yes.	Yes.	Wash; salt on butter worker.
9	What kind of salt; how much to the pound?	Worcester. 3-4 oz.	Worcester, 1 oz.	Worcester. 1 oz.
10	What kind of butter color?	Wells & Richardson.	Wells & Richardson.	Wells & Richardson.
11	What worker used?	Vt. Farm Machine. Round.	Waters.	Eureka.
12	How many pounds of milk required to make one pound butter?	15½ pounds.	About 18 pounds.	16 pounds.
	One or more workings?	One.	One.	One.

STATEMENT OF METHODS EMPLOYED BY WINNERS OF BUTTER PRIZES.—CLASS 2. (DAIRY BOX.)

No.		FIRST PREMIUM. J. H. LOVELAND, Norwich.	SECOND PREMIUM. D. W. ROBERTS, N. Pomfret.	THIRD PREMIUM. S. HEWITT, N. Pomfret.
1	What number and breed of cows from which this butter was made?	26 Grade Jerseys.	8 Grade Jerseys.	25 Jersey and Grades.
2	How much and what kinds of feed were used per cow?	4 pounds gluten, bran and cotton seed; 20 lbs. ensilage and good hay.	3 lbs. meal, 3 lbs. bran, 1 lb. gluten; cornfodder and rowen, what they will eat.	5 lbs. corn meal and bran, 25 lbs. ensilage and what hay they will eat.
3	What is the cost of this ration per day?	17 cents.		15 cents.
4	By what process or apparatus was the cream obtained?	National Separator.	Sharples Separator.	Empire Separator.
5	How long was the cream kept, and in what condition when put in the churn?	48 hours; acid, slight.	Twice a week; acid.	Twice a week; thickened.
6	At what temperature was the cream? Kind of churn used?	62° barrel churn.	64°. Davis Swing.	64°. Stoddard.
7	What length of time churning?	35 minutes.	½ to ¾ hour.	30 minutes.
8	Do you wash and salt it while in granular form?	Yes.	Wash in churn, salt in worker.	Wash; salt on worker.
9	What kind of salt, and how much to the pound?	Worcester, 1-2 oz.	Worcester, 2-5 oz.	Worcester, 5-8 oz.
10	What kind of butter color used?	Wells & Richardson.	Thatcher.	Wells & Richardson.
11	What kind of worker used?	Waters.	Lever.	Waters.
12	How many pounds of milk required to make one of butter? One or more workings?	17 pounds.	15 pounds.	16½ pounds.
		One.	One.	One.

STATEMENT OF METHODS EMPLOYED BY WINNERS OF BUTTER PRIZES.—CLASS 3. (DAIRY PRINTS.)

No.		FIRST PREMIUM. I. B. CLANDON, Chittenden.	SECOND PREMIUM. C. A. CHOATE, W. Barnet.	THIRD PREMIUM. N. S. WALKER, Clarendon.
1	What number and breed of cows from which this butter was made?	19—Natives and Grade Jerseys.	28—Grade Jerseys.	30—Low Grade Holsteins
2	How much and what kinds of feed used per cow?	Ensilage 35 lbs., Bran 4 lbs., Hay 10 lbs., Gluten 2 lbs.	2 feeds corn fodder, 1 hay, 4 quarts bran, 1 cottonseed meal, 2 gluten.	Hay, 4 qts. bran, 25 lbs. ensilage.
3	What is the cost of ration per day?	10 cents.	10 to 15 cents.	Kept no account of cost.
4	By what process or apparatus was the cream obtained?	DeLaval Separator.	DeLaval Separator.	U. S. Separator.
5	How long was the cream kept and in what condition when put in the churn?	4 milkings—Cream warmed to 64°, 20 hours before churning and starter added. Thick and slightly acid.	3½ days. Slightly acid.	24 and 48 hours. Mixed. Slightly acid.
6	What temperature was the cream? Kind of churn used?	62°—Barrel (Stoddard's.)	65° to 68°. Dash.	58°. Barrel.
7	What length of time churning?	40 minutes.	20 to 30 minutes.	About 30 minutes.
8	Do you wash and salt while in granular form?	Yes.	No.	Yes.
9	What kind of salt, and how much to the pound?	Worcester, 1-2 oz.	Genesee 2-3 oz.	Worcester, 3-4 oz.
10	What kind of butter color used?	Wells & Richardson.	Thatcher's.	Wells & Richardson.
11	What kind of worker used?	Waters.	Reed.	Worked in churn.
12	How many pounds of milk required to make one of butter? One or more workings?	17½ pounds. One.	Estimated from 15 to 18 lbs.	20 pounds. One.

STATEMENTS OF METHODS EMPLOYED BY WINNERS OF BUTTER PRIZES. (CLASS 4.) (CREAMERY TUBS.)

No.		FIRST PREMIUM. G. M. HAYWARD, E. Corinth.	SECOND PREMIUM. T. E. DONAHUE, Hinesburgh.	THIRD PREMIUM. GEO. A. DOE, Corinth.
1	What number and breed of cows from which this butter was made?	About 500. Mostly Jerseys.		About 500. Mixed and Grade Jerseys.
2	How much and what kinds of feed used for cows?			
3	What is the cost of this ration per day?			
4	By what process or apparatus was the cream obtained?	Danish Western Separator.	De Laval Separator.	U. S. Separator.
5	Hew long was cream kept and in what condition when put in churn?	24 hours. Well ripened.	24 hours. Slightly acid.	24 hours. Partly acid.
6	What temperature was cream? Kind of churn used?	60°—Square box.	58°—Box.	60°—Square box.
7	Length of time churning?	50 minutes.	45 minutes.	35 minutes.
8	Do you wash and salt while in granular form?	Yes.	Yes.	Yes.
9	What kind of salt and how much to the pound?	Worcester—1 oz.	Worcester—3 4 oz.	Worcester—1 oz.
10	What butter color used?	Wells & Richardson.	Wells & Richardson.	Wells & Richardson.
11	What worker used?	Mason (power.)	National.	Vt. F. M. table.
12	How many pounds of milk required to make one of butter? One or more workings?	18 lbs. One.	18 lbs. One.	18 lbs. One.

STATEMENTS OF METHODS EMPLOYED BY WINNERS OF BUTTER PRIZES—CLASS 5. (CREAMERY PRINTS.)

No.		FIRST PREMIUM. F. L. SMITH, Fletcher.	SECOND PREMIUM. C. B. VINCENT, Glover.	THIRD PREMIUM. Farmers Mutual Creamery St. Johnsbury.
1	What number and breed of cows from which this butter was made?	60—mixed breed.	Jerseys.	1400 cows.
2	How much and what kinds of feed used per cow?			
3	What is the cost of this ration per day?			
4	By what process or apparatus was cream obtained?	U. S. Separator.	U. S. Separator.	Seperators and cold water setting.
5	How long was cream kept? In what condition when put in churn?	24 hours. Acid.	12 hours. Fully Acid.	48 hours. Acid.
6	At what temperature was cream? Kind of churn used?	58°—Square box.	65°	62°—Stoddard box.
7	Length of time churning?	30 minutes.	50 minutes.	30 minutes.
8	Do you wash and salt while in granualar form?	No.	Yes.	Yes.
9	What kind of salt, and how much to the pound?	Worcester, 7-8 oz.	Worcester, 1 oz.	Worcester, 3-4 oz.
10	Kind of butter color used?	Wells & Richardson.	Wells & Richardson.	Wells & Richardson.
11	Kind of worker used?	Fargo.	National.	National.
12	How many pounds of milk required to make one pound of butter?	19 pounds.		19 pounds.
	One or more workings?	One.		One.

STATEMENTS OF METHODS EMPLOYED BY WINNERS OF CHEESE PRIZES. CLASS A. (DAIRY PLAIN.)

No.		FIRST PREMIUM. J. C. OLIVER, W. Charlestown	SECOND PREMIUM. ALPHA MESSER, Rochester.	
1	What number and breed of cows from which this cheese was made?	14—Natives.	4—Grade Devons.	
2	What was their feed?	Corn fodder and clover.	Pasture feed.	
3	Was milked aerated, and by what process?	By pouring.	No.	
4	What was age and temperature of milk when rennet was applied?	80° night and morning.	84° night and morning.	
5	What preparation of rennet used and how much per thousand pounds milk?	Home prepared calves. About 3 teacupsfuls for 40 lbs. cheese.	Factory rennet.	
6	Describe your method of procedure through the remainder of process of making?	After adding rennet let stand 20 minutes then cut and let stand till whey is formed; warm it and cut with curd, repeat three times, keep temperature about 80°, salt one teacup to 20 lbs. curd, cool and press.	Common dairy process.	
7	How many pounds of milk for 1 lb. cheese?	9 lbs.	8¾ lbs.	
8	How long ago was cheese made?	Made September 23.	Made in September.	
9	What was the average net price received for your cheese last season from May 1 to November 1?	12 cents.		

STATEMENT OF METHODS EMPLOYED BY WINNERS OF CHEESE PRIZES. (CLASS B.) (DAIRY SAGE.)

No.		FIRST PREMIUM. J. C. OLIVER, W. Charleston.	SECOND PREMIUM. ALPHA MESSER, Rochester.	THIRD PREMIUM.
1	What number and breed of cows from this cheese was made?	14 natives.	4 grade Devons.	
2	What was their feed?	Corn fodder and clover.	Pasture feed.	
3	Was the milk aerated and by what process?	By pouring.	No.	
4	What was the age and temperature of the milk when the rennet was applied?	Night and morning. 80°.	Night and morning. 84°.	
5	What preparation of rennet did you use, and how much per 1000 pounds?	Home made calves rennet—3 teacups to 40 lbs. cheese.	Factory rennet.	
6	Describe your method of procedure through the remainder of making?	Let stand after adding rennet 20 minutes then cut—heat whey and mix with the curd—repeat three times. 1 cup salt to 20 lbs. cheese.	Common dairy process.	
7	How long ago was this cheese made?	Made Sept, 24.	Made in September.	
3	How many pounds of milk for one pound of cheese?	About 9 lbs.	8¾.	
9	What was the average net price received for your cheese per pound last season, from May 1st to November 1st?	12 cents.		

STATEMENTS OF METHODS EMPLOYED BY WINNERS OF CHEESE PRIZES. CLASS C. (FACTORY PLAIN.)

No.		FIRST PREMIUM. P. M. McDonough, Hinesburgh,	SECOND PREMIUM. C. H. Weed, Essex.	THIRD PREMIUM. Geo. Johnson, Chippenhook.
1	What number and breed of cows from which this cheese was made?	400 Mixed Breed.	Mixed Breed.	175 Mixed Breed.
2	What was their feed?	Grass and corn-fodder.		Grass.
3	Was the milk aerated and by what process?	Yes; by dipping.	No.	Stirring.
4	What was the age and temperature of milk when the rennet was applied?	Nights and mornings. 85°.	6 hours. 84°.	15 hours. 86°.
5	What preparation of rennet was used and how much per 1000 pounds milk?	Home preparation.	Extract. 4 oz.	Hanson's R Extract. 3½ per thousand.
6	Describe your method of procedure through remainder of process of making.	Heat to 100°. Let stand until it would string ½ inch from hot iron.	Old way.	Heated to 100°. Left in whey 2 hours, 55 min.
7	How long ago was this cheese made?	About 2 months.	September.	October 20.
8	How many pounds of milk did you require to make one pound of cheese?	8½ pounds.	9.	9 13-100.
9	What was the average net price received for your cheese per pound last season from May 1 to Nov. 1.	9 cents.		75 cents per hundred.

STATEMENTS OF METHODS EMPLOYED BY WINNERS OF CHEESE PRIZES. CLASS D. (FACTORY SAGE.)

No.		FIRST PREMIUM. T. B. HARRIETT, N. Georgia.	SECOND PREMIUM. P. M. McDONOUGH, Hinesburgh.	THIRD PREMIUM. EDW. BISSONETT, Addison.
1	What number and breed of cows from which this cheese was made?	400 Natives.	400 mixed breed.	Grades and Jerseys.
2	What was their feed?	Pasture.	Grass and cornfodder.	Grass and cornfodder.
3	Was the milk aerated and by what means?	No.	Yes; by dipping.	Yes; by dipper.
4	What was the age and temperature of milk when rennet was applied?	12 to 24 hours.	Nights and mornings. 85°.	85°.
5	What preparation of rennet did you use and how much per 1000 pounds?	Hanson's extract. 3 oz. per 1000.	Home preparation.	G. W. Curtis, 4 oz.
6	Describe your method of procedure through the rest of the process of making?	Heat to 86°. Cook to 98°. Draw whey at ¼ in acid. Grind at one in acid. Salt 3 lbs. to thousand.	Cut and heat to 100°. Let stand until it will string ½ inch on hot iron.	Heat to 98°. Remain in whey 3 hours. Dry sage added.
7	How long ago was this cheese made?	Sept. 20.	About two months ago.	3 months.
8	How many pounds of milk did you require to make one pound cheese?	10 lbs.	8½ pounds.	9 pounds.
9	What was the average net price received for your cheese per pound last season from May 1 to Nov. 1.		9 cents.	10 cents.

NOTE.

The dairy exhibit exceeded in both quality and quantity those of previous years. It shows that we as dairymen of Vermont are awakening greater interest in the production of better dairy products.

In the exhibits of private dairy butter, there were only twelve samples out of seventy-eight that scored below ninety points, while of the creamery butter, only one sample out of forty-nine scored below ninety points.

LICENSED OPERATORS OF THE BABCOCK TEST.

The following list shows the names and addresses and license numbers of parties who have been licensed up to and including May 8, 1899, in accordance with Section 2 of No. 81 of the Acts of 1898.

SECTION 2. Each and every person who, either for himself or in the employ of any other person, firm or corporation, manipulates the Babcock test, or any other test, whether mechanical or chemical, for the purpose of measuring the contents of butter fat in milk or cream as a basis for apportioning the value of such milk or cream, or the butter or cheese made from the same, shall secure a certificate from the superintendent of the dairy school of the University of Vermont and State Agricultural College that he or she is competent and well qualified to perform such work. The rules and regulations in the application for such certificate and in the granting of the same shall be such as the superintendent of the school may arrange. The fee for issuing such certificate shall in no case exceed one dollar, the same to be paid by the applicant to the superintendent of the dairy school and to be used by the superintendent in meeting the expenses incurred under this section.

NAMES.	ADDRESSES.	LICENSE No.
Aldrich, E. C.	Shrewsbury	202
Aldrich, W. E.	No. Shrewsbury	203
Allbee, Guy H.	No. Underhill	108
Allen, Henry W.	So. Strafford	42
Allen, Henry D.	Jacksonville	183
Alston, Walter H.	Craftsbury	98
Anderson, A. H.	Albany	61
Andrews, A. W.	Wallingford	8
Averill, George F.	Waitsfield	29
Bailey, E. S.	Lunenburg	124
Bailey, O. W.	Westfield	208
Baker, G. M.	Orwell	175
Barrett, R. A.	N. Thetford	38
Baxter, S. O.	Middlesex	212
Beach, Wm. V.	Charlotte	157
Bedell, Clarence	E. Ryegate	4
Belden, H W.	Richmond	162
Bessette, Henry	N. Ferrisburg	111
Bickford, F. H.	Bradford	40
Bigelow, A. P.	Wolcott	23
Bond, Jno.	Marshfield	22

Bond, S. L.	Wilmington	28
Bostwick, E. R.	Londonderry	148
Boynton, D. A.	Weston	195
Briggs, F. C.	Bristol	85
Brock, H. E.	Barnet	59
Brothers, H. F.	Hinesburgh	103
Bruce, M. K.	Passumpsic	44
Bruce, T. H.	Starksboro	86
Bruce, H. C.	Sharon	220
Buckley, J.	Wheelock	72
Bunker, Henry J.	W. Rutland	106
Burr, W. B.	Grand Isle	156
Burns, Dennis	Brookside	219
Butler, Thomas	E. Monkton	141
Campbell, G. E.	Newport Center	27
Campbell, E. S.	Hyde Park	91
Chamberlin, H. D.	Wells River	3
Chamberlin, H. B.	Coventry Falls	7
Cofrin, James F.	Northfield	110
Covey, Harmon A.	Evansville	152
Crowley, A. W	Healdville	205
Crown, H. E.	Essex Junction	80
Cushman, H. P.	Putney	24
Dart, E. G.	Huntington Center	128
Demerritt, N. L.	Waterbury Center	19
Derby, E. E.	Northfield	147
Dickerman, E. W.	Pittsford	10
Doe, George A.	Corinth	145
Dodds, D. L.	North Hero	125
Donahue, D. G.	Charlotte	177
Donahue, J. F.	Colchester	102
Donahue, M. T.	Ferrisburgh	126
Donahue, T. E.	Hinesburgh	101
Draper, F. W.	North Sheldon	46
Dutcher, F. D.	Stamford	213
Easton, Loren	Castleton	82
Eddy, C. F.	Waitsfield	54
Everest, George C.	Vergennes	15
Farrar, Seymour	E. Poultney	107
Farwell, Joseph W.	Chester	151
Faulkner, J. S.	Readsboro	63
Fife, J. A.	Waterbury	181
Fish, W. L.	Bethel	158
Fleming, M. L.	Fairfax	77
Flint, B. S.	Swanton	216
Foote, C. P.	Middlebury	87
Freeman, H. H.	Waterbury Center	75
Frost, O. S.	Rutland	168
Fuller, Edwin D.	Chelsea	135
Fuller, C. C.	Richmond	211
Gibson, E. A.	Derby	174
Giddings, Frank L.	Grand Isle	182
Gordon, F. E.	Chazy, N. Y.	65
Goss, Charles	Walden	120
Graves, C. C.	Poultney	109
Gray, A. D.	Brighton	206

Gray, S. E.	Morgan	45
Greenleaf, C. A.	Newbury	137
Hackett, D. H.	Barton Landing	70
Hardy, N. S.	Sheffield	43
Harris, S. L.	Starksboro	94
Hastings, C. A.	Springfield	100
Hatt, B. A.	South Ryegate	47
Hawley, B.	Williamstown	160
Hays, F. D.	Rupert	62
Hayward, G. M.	E. Corinth	83
Hazen, H. A.	No. Hero	58
Hewitt, H. E.	Bristol	68
Hickok, A. H.	Oakland	76
Hill, Edson K.	Passumpsic	153
Hillis, E. C.	N. Montpelier	31
Hinds, E. E.	Eden	51
Hobson, E. F.	Brighton	207
Holland, P. H.	Townsend	210
Holmes, John	Shoreham	67
Holmes, H. A.	Fairfax	197
Hooper, Arthur	N. Cambridge	184
Hosford, C. J.	Wells River	221
Howe, J. W.	Montpelier	138
Howland, W. J.	Jericho Centre	164
Hulett, C. W.	Rochester	133
Humphrey, G. E.	Poultney	104
Hunt, E. W.	Danville	114
Isham, Icabod A	Talcott	92
Jackson, J. J.	E. Montpelier	41
James, F. H.	Middlebury	149
Jaynes, R. F.	Ryegate	17
Jenks, U. S.	Rutland	169
Jenks, W. W.	No. Clarendon	170
Jennings, B. C.	So. Walden	113
Johnson, Geo.	Chippenhook	74
Johnson, T. W.	Huntington	20
Johnson, Thos.	Craftsbury	71
Jones, C. W.	Sudbury	5
Jones, A. G.	Sudbury	6
Jones, C. T.	Middletown Springs	185
Judd, Alson B.	St. Albans	1
Kelley, G. A.	Marshfield	21
Kendall, I. H.	Enosburgh Falls	57
Kibbey Fred S.	Fairlee	196
Lackie, W. S.	So. Ryegate	218
Landon, T.	Barton Landing	25
Landon, W. A.	Johnson	112
Langdon, L. E.	Oakland	39
Lawless, C. C.	N. Montpelier	143
Layton, J. W.	West Newbury	159
Leach, M. B.	Essex	2
Leary, J. A.	Jonesville	96
Leonard, L. O.	E. Calais	131
Leonard, M. J.	Shoreham	88
Lewis, A. L.	So. Royalton	18

Lewis, Chester E.	Wells	187
Longley, J. N.	St. Albans	55
Lord, W. H.	Mt. Holly	200
McAllister, H. W.	Moretown	122
McBride, C. W.	Underhill	89
McBurney, A. K.	Barnet	172
McDonough, P. H.	Hinesburgh	81
McGovern, Wm. L.	Williston	161
McLam, James F.	So. Ryegate	33
Macomber, F. C.	Cambridge	66
Martin, Frank E.	Cuttingsville	201
Micott, M. R.	Brattleboro	173
Miller, I. G	Westminster	73
Miller, John R.	Westfield	209
Mooney, P. E.	Pittsford	214
Morse, Karl E.	So. Peacham	179
Nay, Y. G.	Jericho	171
Needham, A. P.	Vergennes	105
Nichols, Dr. Geo. B.	Barre	215
Noble, H. A.	Brookfield	217
Norcross, W. C.	Hortonville	139
Norton, J. B.	Waitsfield	116
Ochampaugh Ed. F.	Orwell	191
Orton E. F.	Fairfax	192
Palmer, Geo.	New Haven	14
Palmer, Chas. E.	New Haven	16
Parsons, M. L.	W. Braintree	56
Perry, Chas. C.	Benson	178
Pierce, Clarence K.	Cold River	97
Pierce, Edson N.	W. Windsor	167
Pierce, L. S.	Morrisville	166
Plumley, R. E.	Cold River	204
Pratt, Fred M.	Mt. Holly	188
Pride, W. O.	E. Roxbury	12
Reynolds, M. W.	Johnson	37
Rich, J. L.	Berlin	30
Richardson, L. H.	So. Royalton	117
Richter, F. E.	Whitehall, N. Y.	99
Robinson, D. M.	South Hero	127
Robbins, F. H.	Holland	144
Rolfe, I. G.	St. Johnsbury	155
Rollins, Carl C.	Waterbury	189
Russell, F. L.	Shrewsbury	165
Ryan, Wm.	Craftsbury	132
Safford, H. F.	Burlington	50
Sanborn, L. F.	West Topsham	176
Scott, E. V.	Greensboro	134
Shattuck, B. C.	Hanksville	190
Simpson, W. G.	Washington	84
Slack, Earl N.	Woodstock	194
Smith, B. G.	Fletcher	78
Smith, Edgar F.	Plainfield	26
Smith, F. L.	Fletcher	118
Smith, L. W.	Keene, N. H.	49
Stearns, H. V.	E. Johnson	193

Stevens, N. C.	West Glover	146
Stone, W. P.	Norwich	136
Storrs, A. A.	E. Bethel	35
Strong, G. W.	Burlington	64
Strong, Neltie E.	Hinesburgh	163
Sumner, Geo. H.	W. Brookfield	11
Symes, G. H.	So. Peacham	32
Symes, E. E.	So. Ryegate	48
Symes, Horace	Ryegate	52
Taft, L. H.	No. Williston	130
Thomas, C. A.	East Monkton	142
Thomas, Horace	Binghamville	154
Towne, E. R.	Waterbury	180
Vincent, C. B.	Glover	121
Walker, Charles E.	Keeler's Bay	90
Walker, George C.	South Hero	13
Ward, S. L.	West Fairlee	60
Warner B. F.	Burke	36
Watkins, W. H.	East Hardwick	186
Wells, E. O.	Irasburgh	93
Wetherbee, A. N.	Lyndonville	123
Wetherbee, W. G.	Vershire	9
Wheeler, C. A.	West Charleston	119
Whitehill, C. E.	Barnet	140
Whitelaw, F. R.	Randolph	34
Whitman, L. B.	Weybridge	199
Whitney, H. O.	Williston	79
Whitney, H. A.	Norwich	115
Wilcox, Arthur B.	Hartford	222
Wilcox, G. I.	Woodstock	129
Willard, A. D.	Vergennes	95
Wilson, David	Rupert	53
Wilson, Glen	Braintree	69
Wood, G. P.	Tinmouth	198
Wood, Peter	Fair Haven	150

1899 LIST OF CREAMERIES AND CHEESE FACTORIES, STATE OF VERMONT.

ADDISON COUNTY CREAMERIES.

New Haven Mills Co-op Cry. Co	New Haven Mills
Reef Bridge Cry. Asso. (Co-op)	Weybridge
Ferrisburgh Creamery Co. (Co-op)	Ferrisburgh
Allen Creamery (Proprietary)	North Ferrisburgh
Cornwall Creamery (Proprietary)	West Salisbury
Cream Hill Creamery (Proprietary)	Creamhill
Champlain Valley Cr'y (Proprietary)	Creamhill
Fair Valley Creamery	Middlebury
Allen Dale and Elgin Spring Cr'y (Proprietary)	Vergennes
Baldwin Creek Creamery (Proprietary)	Starksboro
Champlain Valley Creamery (Proprietary)	Vergennes
Champlain Valley Creamery (Proprietary)	North Ferrisburgh
Cloverleaf Creamery	Orwell
Ferrisburgh Creamery Co	Ferrisburgh
Otter Creek Creamery	Vergennes
Green Mountain Cold Spring Cr'y Asso	Starksboro
Riverside Condensed Milk Co	Bristol
T. H. Armstrong Cr'y	Leicester Junction
East Monkton Cr'y Asso	East Monkton
North Cornwall Cr'y (Proprietary)	Middlebury

ADDISON COUNTY CHEESE FACTORIES.

Orwell Chesse Factory Co., (Co-op)	Orwell
Shoreham Cheese Factory M'f'g Co. (Proprietary)	Shoreham
Beaver Glen Factory (Co-op)	New Haven
Otter Creek Factory (Co-op)	Vergennes
Champlain Valley Cheese Factory (Proprietary)	Bridport
Farmingdale Cheese Factory (Stock Co.)	East Middlebury
Addison Cheese Factory	Addison

BENNINGTON COUNTY CREAMERIES.

Stamford Elgin Butter Factory (Co-op)	Stamford
South Shaftsbury Cr'y Asso. (Co-op)	South Shaftsbury
Elgin Creamery Asso	Readsboro

BENNINGTON COUNTY CHEESE FACTORIES.

Manchester Cheese Factory Asso. (Stock Co.)	Manchester Ctr.
East Rupert Dairy Asso. (Co-op)	East Rupert
Rupert Dairy Asso. (Co-op)	Rupert
Rose Cheese Factory (Proprietary)	West Rupert
East Dorset Cheese Asso	East Dorset
Dorset Cheese Factory (Stock Co.)	Dorset
Green Mountain Cheese Factory	Winhall
Peru Cheese Co. (Stock Co.)	Peru
Mettowee Cheese Factory	East Rupert
Dolly Varden Cheese Factory	West Rupert

CALEDONIA COUNTY CREAMERIES.

Walden Creamery (Co-op)	South Walden
Lamoille Valley Cr'y Asso. (Co-op)	East Hardwick
Farmers' Mutual Cr'y Co. (Co-op)	St. Johnsbury
Passumpsic Cr'y Asso. (Co-op)	Passumpsic
North Ryegate Co-op. Cr'y Co.	South Peacham
Trout Brook Creamery Co. (Co-op)	West Waterford
Danville Creamery Asso. (Co-op)	Danville
South Peacham Co-op. Cr'y Co.	South Peacham
Noyesville Co-op. Cr'y Asso.	Walden
South Ryegate Co-op. Cr'y Asso.	South Ryegate
East Ryegate Co.op. Cr'y Asso.	East Ryegate
Sheffield Co-op. Creamery Asso.	Sheffield
Burke Creamery Co.	Burke
Jersey Hill Creamery	Ryegate
Barnet Creamery Asso.	Barnet
Lyndonville Creamery Asso.	Lyndonville
East Peacham Creamery (Co-op.)	East Peacham

CHITTENDEN COUNTY CREAMERIES.

Colchester Co-op. Butter and Cheese Factory	Colchester
T. W. Tower's Creamery	Richmond
Cloverdale Creamery Co. (Stock Co)	North Underhill
Winooski Valley Co-op. Cr'y	North Williston
Shelburne Co-op. Cr'y Co	Shelburne
Lake View Creamery (Co-op)	Charlotte
Oak Hill Co-op. Cr'y Asso.	Talcott
Valley Falls Creamery (Co-op)	Hinesburgh
Queen City Creamery (Proprietary)	Jericho
Clover Hollow Creamery (Proprietary)	Essex
Essex Creamery (Proprietary)	Essex Junction
Jonesville Creamery Asso.	Jonesville
Crystal Spring Cr'y Co.	East Charlotte
Hanksville Co-op. Cr'y	Hanksville
Richmond Co-op. Cr'y Co.	Richmond
Williston Co-op. Cr'y Asso.	Williston
G. M. Norton's Creamery	Huntington
Green Mountain Creamery	Huntington
Vermont Condensed Milk Co.	Richmond
F. Allen Creamery	Westford
West Bolton Creamery	West Bolton

CHITTENDEN COUNTY CHEESE FACTORIES.

Union Cheese Factory (Co-op)	Westford
Browns' River Cheese Factory Co. (Stock Co)	Essex Center
MacDonough Cheese Factory (Proprietary)	Hinesburgh

ESSEX COUNTY CREAMERIES.

Hobson Creamery (Co-op)	Island Pond
Moose River Creamery Co. (Co-op)	Gallup Mills
Lunenburg Co-op. Cr'y Asso	Lunenburg
Concord Creamery (Proprietory)	West Concord

FRANKLIN COUNTY CREAMERIES.

Franklin County Cr'y Asso. (Stock Co)	St. Albans
Marcy's Creamery (Proprietary)	Montgomery Ctr.
Cloverleaf Creamery (Proprietary)	Fletcher

Maple Leaf Creamery (Proprietary)	Morses Line
Star Creamery (Proprietary)	Binghamville
North Sheldon Creamery	Enosburgh Falls
Fairfax Creamery	Fairfax
Oakland Creamery	Oakland
Sheldon Creamery	Sheldon
Fairfield Creamery	Fairfield

FRANKLIN COUNTY CHEESE FACTORIES.

Green Valley Cheese Factory (Proprietary)	East Swanton
Milton Boro Cheese Factory (Proprietary)	Georgia Plain

GRAND ISLE COUNTY CREAMERIES.

Grand Isle Co-op. Cr'y	Pearl
North Hero Creamery (Proprietary)	North Hero
South Hero Creamery Co.	South Hero
Alburgh Creamery (Proprietary)	Alburgh
Samson Co-op. Cr'y Co.	Grand Isle
Home Dairy Creamery	East Alburgh

LAMOILLE COUNTY CREAMERIES.

Mount Mansfield Cr'y (Proprietary)	Stowe
Bell Brook Creamery (Proprietary)	East Johnson
Stearns Creamery (Proprietary)	Cambridge
Hyde Park Creamery	Hyde Park
North Cambridge Creamery	North Cambridge
Gihon Creamery (Proprietary)	Johnson
Riverside Creamery (Proprietary)	Wolcott
Morrisville Creamery	Morrisville

LAMOILLE COUNTY CHEESE FACTORIES.

Johnson Cheese Factory	Johnson

ORANGE COUNTY CREAMERIES.

Bradford Cr'y Co. (Stock Co)	Bradford
Randolph Creamery (Proprietary)	Randolph
North Thetford Cr'y Co. (Co-op)	North Thetford
Randolph Co-op Cr'y Co.	Randolph
Vershire Creamery Co. (Co-op)	Vershire
Orange County Creamery Co. (Co-op)	Chelsea
Washington Creamery Asso. (Co-op)	Washington
Topsham Co-op. Cr'y Co.	Topsham
Wachusett Creamery Co. (Proprietary)	West Brookfield
Riverside Creamery (Proprietary)	South Newbury
Wells River Creamery Co. (Co-op)	Wells River
West Braintree Creamery (Proprietary)	West Braintree
Corinth Cr'y Co. (Stock Co)	Corinth
East Corinth Creamery Co. (Stock Co)	East Corinth
Lake Morey Creamery	Fairlee
Newbury Village Creamery	Newbury
Strafford Cr'y Co. (Stock Co)	Strafford
Wells River Creamery	Newbury
Green Mountain Creamery Co. (Stock Co)	West Topsham
Temple Creamery	Randolph Center
East Topsham Cr'y Co.	East Topsham
E. H. Thayer's Cr'y.	West Brookfield
South Bradford Cr'y	South Bradford

ORANGE COUNTY CHEESE FACTORIES.

Brookfield Cheese Factory (Proprietary) ..... Brookfield

ORLEANS COUNTY CREAMERIES.

Clyde River Cr'y (Co-op) ..... East Charleston
Highland Creamery (Co-op) ..... Derby
Meadow Brook Creamery (Proprietary) ..... West Glover
Black River Creamery (Co-op) ..... Coventry
Black River Cheese and Butter Co. (Proprietary) ..... Craftsbury
Holland Creamery Asso. (Co-op) ..... Holland
Mill Village Creamery (Proprietary) ..... North Craftsbury
Green Mountain Creamery Co. (Proprietary) ..... Westfield
Willoughby Creamery (Proprietary) ..... Barton Landing
Lowell Creamery (Proprietary) ..... Lowell
Orleans County Creamery ..... North Troy
Evansville Co-op. Cr'y Asso. ..... Evansville
Mill Village Cr'y and Cheese Factory ..... Irasburgh
Glover Creamery Co. ..... Glover
Caspian Lake Creamery Co. (Proprietary) ..... Greensboro
Wm. Ryan's Cr'y ..... Craftsbury
Newport Center Cr'y (Proprietary) ..... Newport Center
West Charleston Cr'y Co. ..... West Charleston

ORLEANS COUNTY CHEESE FACTORY.

North Troy Cheese Factory ..... North Troy

RUTLAND COUNTY CREAMERIES.

Middletown Cheese and Butter Co. (Stock Co.) ..... Middletown Springs
The Marshall Creamery (Proprietary) ..... North Clarendon
Benson Creamery (Proprietary) ..... Benson
Champlain Valley Creamery (Proprietary) ..... Fair Haven
Lake Side Creamery (Proprietary) ..... Mechanicsville
Rutland County Cr'y (Proprietary) ..... Pittsford
Otter Creek Creamery ..... Sudbury
Wallingford Creamery (Proprietary) ..... Wallingford
Lake Hortonia Co-op Cr'y Co. ..... Hubbardton
Hudson Valley Cr'y Co. ..... Poultney
Rutland Creamery ..... Rutland
Lakside Creamery Co. ..... Wells
S. C. Gorham's Cr'y ..... West Rutland
Nickwackett Cr'y ..... Pittsford
Pittsford Creamery (Proprietary) ..... Pittsford

RUTLAND COUNTY CHEESE FACTORIES.

J. D. S. Packer Cheese Factory ..... Mt. Holly
Tarbell Cheese Factory (Proprietary) ..... Mechanicsville
Hebron Union Cheese Factory (Proprietary) ..... West Pawlet
East Poultney Cheese Mfg. Co. (Co-op) ..... East Poultney
West Pawlet Dairy Co. (Co-op) ..... West Pawlet
Mt. Holly Cheese Factory (Proprietary) ..... Mt. Holly
Smithtown Cheese Factory Co. (Co op) ..... West Rutland
H. C. Gleason Cheese Factory (Proprietary) ..... Shrewsbury
The Hoskinson Cheese Factory (Proprietary) ..... Healdville
Flower Brook Cheese Factory (Proprietary) ..... Pawlet
Peter Pelkey's Cheese Factory (Proprietary) ..... East Wallingford
Riverside Cheese Factory (Co-op) ..... Ira

Eureka Cheese Factory (Proprietary) ..... Wells
Blakely Cheese Factory (Co-op) ..... Pawlet
East Pittsford Cheese Factory (Proprietary) ..... East Pittsford
Lewisville Cheese Factory (Proprietary but governed as Co-op) ..... Wells
Chippenhook Cheese Factory ..... Chippenhook
Hillside Cheese Factory ..... Danby Four Corners
Lake Side Cheese Factory (Proprietary) ..... Mechanicsville
W. E. Aldrich Cheese Factory ..... North Shrewsbury
Maple Grove Cheese Factory (Proprietary) ..... Pawlet
Gilt Edge Cheese Co. ..... East Hubbardton
W. E. Edson Cheese factory ..... East Pittsford
F. F. Peters Cheese Factory ..... Ira
Union Cheese Factory ..... South Wallingford
Chas. Hawkins Cheese Factory ..... East Wallingford
A. W. Crowley's Cheese Factory ..... Healdville

WASHINGTON COUNTY CREAMERIES.

Cabot Creamery Co. (Co-op) ..... Cabot
Cold Spring Creamery (Proprietary) ..... Moretown
Waitsfield Creamery Co. (Co-op) ..... Waitsfield
Plainfield Creamery Co. (Co-op) ..... Plainfield
Calais Cr'y Asso. (Co-op) ..... Calais
Marshfield Co-op. Cr'y Asso. ..... Marshfield
Shady Rill Co-op. Co. ..... Montpelier
North Montpelier Co-op. Cr'y Co. ..... North Montpelier
Capitol Creamery (Proprietory) ..... Montpelier
Clovervale Creamery (Proprietary) ..... Waterbury
Mad River Valley Cr'y (Proprietary) ..... Waitsfield
East Calais Cr'y Co. ..... East Calais
East Montpelier Co-op. Cr'y ..... East Montpelier
Waterbury Creamery (Proprietary) ..... Waterbury
Warren Creamery (Proprietary) ..... Warren
West Northfield Cr'y (Proprietary) ..... West Northfield
Middlesex Cr'y (Proprietary) ..... Middlesex
A. E. Newcomb's Cr'y ..... Waterbury Center
Walker Farm Cr'y (Proprietary) ..... Montpelier
Cloverdale Cr'y (Proprietary) ..... Northfield
Riverside Cr'y ..... Worcester

WINDHAM COUNTY CREAMERIES.

Deerfield Valley Cr'y Asso. (Co-op) ..... Wilmington
Mount Lake Cr'y Co. (Proprietary) ..... South Londonderry
Putney Cr'y Asso. (Co-op) ..... Putney
Brattleboro Cr'y Asso. (Co-op) ..... Brattleboro
Mount Lake Farm Cr'y (Proprietary) ..... North Londonderry
North River Creamery Asso. (Co-op) ..... Jacksonville
Windham County Cr'y (Proprietary) ..... Newfane
Valley Cr'y Asso. (Stock Co) ..... Westminster
Putney Cr'y Asso. ..... Putney

WINDHAM COUNTY CHEESE FACTORY

Putney Cheese Factory ..... East Putney

WINDSOR COUNTY CREAMERIES.

Springfield Co-op. Cr'y Co. ..... Springfield
White River Creamery (Proprietary) ..... Rochester
West Hartford Cr'y Asso. (Co-op) ..... West Hartford

Storrs Creamery (Proprietary)	East Bethel
Maple Creamery (Proprietary)	Woodstock
Norwich Cr'y Co. (Co-op)	Norwich
Oak Leaf Cr'y Co. (Stock Co)	Chester
Sherburne Creamery (Proprietary)	North Pomfret
Harrington Creamery (Proprietary)	Bethel
Sharon Creamery Co. (Co-op)	Sharon
West Windsor Creamery	Brownsville
Waldo Creamery	South Royalton
Woodstock Creamery (Proprietary)	Woodstock
Woodstock Creamery (Co-op)	Woodstock

WINDSOR COUNTY CHEESE FACTORIES.

Enterprise Cheese Co. (Co-op)	Hartland Four Corners
Weston Cheese Co. (Co-op)	Weston
Chester Cheese Co. (Co-op)	North Chester
West Bridgewater Cheese M'f'g Co.	West Bridgewater
The Ludlow Cheese Co.	Ludlow
Simonsville Factory (Co-op)	Simonsville
Andover Dairy Asso. (Co-op)	Andover
West Windsor Cheese M'f'g Co. (Co-op)	Brownsville
East Barnard Cheese Co. (Stock Co)	East Barnard
Excelsior Cheese Factory (Proprietary)	South Reading
Spafford Cheese Co.	Gassetts
Plymouth Notch Cheese Factory	Plymouth
Plymouth Five Corners Cheese Factory	Plymouth

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